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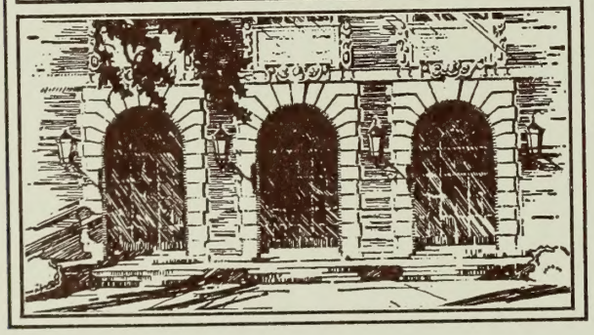

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 3, NUMBER 19
OCTOBER 1, 1970

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W70-07649 -- W70-08148

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 19
OCTOBER 1, 1970

W70-07649 -- W70-08148

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

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FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SUBJECT FIELDS AND GROUPS

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

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05 WATER QUALITY MANAGEMENT AND PROTECTION
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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
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08 ENGINEERING WORKS
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10 SCIENTIFIC AND TECHNICAL INFORMATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

A STUDY OF A SPECIFIC INFLUENCE OF DISSOLVED IONS ON THE STRUCTURE OF WATER,
Rocketdyne, Canoga Park, Calif.
J. Greyson, and H. Snell.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $0.45. Office of Saline Water Research and Development Progress Report No 523, Jan 1970. 32 p, 7 fig, 4 tab, 33 ref. OSW Contract No 14-01-0001-1701.

Descriptors: *Water structure, *Ions, *Solutes, *Thermodynamic behavior, *Desalination processes, Thermodynamics, Water properties, Aqueous solutions, Water chemistry, Heavy water, Membrane processes.
Identifiers: Transfer properties, Transfer free energy.

Entropies of transfer between heavy and normal water for several multivalent cations and several polyatomic anions were determined from combination of heats of transfer obtained from calorimetric measurements with free energies of transfer obtained from cell measurements. The ions investigated included the alkaline earth cations, the group of aliphatic acid anions from the formate through the caproate, and the inorganic anions carbonate, nitrate, sulfate, and sulfite. The standard heat of transfer values for the alkaline earth chlorides and the sodium salts of the inorganic anions indicated an exothermic transfer for the process salt in heavy water to normal water. For the sodium salts of the aliphatic acid anions, the heat of transfer was negative for sodium formate, near zero for sodium propionate and butyrate, and positive for sodium caproate. Calculated entropy values followed the same pattern as the heats. The alkaline earth chlorides (with the exception of magnesium chloride) behave as structure-breaking salts. The structure influence and the concentration dependence of the entropies of transfer of the salts are explained in terms of the Gurney cosphere model. (Knapp-USGS)
W70-07651

STUDIES ON THE DECOMPOSITION OF ORGANIC DETRITUS DERIVED FROM THE TURTLE GRASS THALASSIA TESTUDINUM,
Miami Univ., Fla. Inst. of Marine Science.
Tom Fenchel.
Limnology and Oceanography, Vol 15, No 1, p 14-20, 1970. 5 fig, 16 ref.

Descriptors: *Decomposing organic matter, *Detritus, Biological communities, Oxygen, Bacteria, Diatoms, Amphipoda, Metabolism, Respiration, Ecosystems, Animals, Florida, Sampling, Algae, Nematodes, Fungi, Actinomycetes, Cyanophyta, Rotifers, Food chains, Sea water.
Identifiers: *Turtle grass, Thalassia testidinum, Ciliates, Parhyalella whelpleyi, Flagellates, Fecal pellets, Key Biscayne (Fla), Monas, Oikomonas, Tropidoscyphus, Entosiphon, Bodo, Rhynchomonas, Euplotes, Aspidisca, Uronema marina, Cyclidium, Diophrys, Hydrobia, Littonotus duplostriatus.

Measurements of metabolic rates do not always wholly depict a specific component's role. The quantitative composition of microbial communities living on detrital particles derived from turtle grass Thalassia testudinum was studied. Organism numbers on and rate of oxygen consumption of detritus are approximately proportional to total surface area. Field samples of detritus harbored about 3 billion bacteria, 50 million flagellates, 50,000 ciliates, and 20 million diatoms and consumed from 0.7 to 1.4 milligrams oxygen/hour per gram dry weight. The detritus-consuming amphipod Parhyalella whelpleyi feeds on detrital particles and on its own fecal pellets but only uses the microorganisms; dead plant residue passes undigested through the intestine. After a few days microbial communities living on fecal pellets are qualitatively and quantitatively comparable to those living on other detrital particles. The amphipods decrease detritus particle size thereby increasing its total surface and thus the microbial activity. In less than four days, mechanical activity of amphipods may increase the detrital oxygen uptake by 110% of their own metabolic rate. Measurements of respiratory rates of the amphipods will therefore give a depressed estimate of their total role in the ecosystem. (Jones-Wisconsin)
W70-08109

02. WATER CYCLE

2A. General

WATER RESOURCES OF NEW MEXICO: OCCURRENCE, DEVELOPMENT, AND USE,
New Mexico State Engineer Office, and New Mexico Interstate Stream Commission.
For primary bibliographic entry see Field 06D.
W70-07786

THE ESTIMATION OF RUNOFF FROM RAINFALL FOR NEW BRUNSWICK WATERSHEDS,
Nelson Basin Board, Regina (Saskatchewan); and New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
J. Lee, and D. I. Bray.
Journal of Hydrology, Vol 9, No 4, p 427-437, December 1969. 11 p, 1 fig, 3 tab, 11 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical methods, Antecedent precipitation, Rainfall, Precipitation (Atmospheric), Regression analysis, Hydrograph analysis, Equations, Runoff forecasting, Depth-area-duration analysis, Infiltration.
Identifiers: *New Brunswick (Canada).

Prediction equations have been derived for forecasting runoff volume for regions within the Province of New Brunswick. Five basins were selected so as to provide a regionally representative distribution over the province. The prediction equations are based on the storm rainfall, antecedent precipitation index, base flow and week number in which the storm occurred. Statistical methods were used to obtain the least-squares multiple linear regression equation, correlation coefficient, and the standard error for each of the techniques used for the watersheds. The number of storms varied from 8 to 23 for the basins studied. The standard error of the optimum prediction equations for runoff ranged from 0.065 inches to 0.212 inches and the multiple correlation coefficient (R) varied from 0.556 to 0.963. The results of the regression equations developed for one basin were extended to a neighboring basin of similar hydrological characteristics but with only recent streamflow records. (Knapp-USGS)
W70-07904

RAINFALL-RUNOFF RELATIONSHIPS EXPRESSED BY DISTRIBUTION PARAMETERS,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
Emil O. Frind.
Journal of Hydrology, Vol 9, No 4, p 405-426, December 1969. 22 p, 10 fig, 15 ref.

Descriptors: *Rainfall-runoff relationships, *Statistical models, Statistics, Parametric hydrology, Runoff forecasting, Recession curves, Simulation analysis, Synthetic hydrology, Mathematical models, Computer models, Probability, Stochastic processes.
Identifiers: Log normal distributions, Gamma distributions.

The statistical parameters of precipitation and runoff, and the interrelations between corresponding parameters involve three processes: the input process (mean annual effective precipitation), the transformation process (basin storage), and the output process (mean annual runoff). The input is assumed to be a pure-random series, with known statistical parameters. The transformation is characterized by an exponential recession curve with one parameter. With these assumptions, equations are developed expressing the statistical parameters of the output for any length of carryover. The validity of these equations is confirmed by means of computer-simulated series, which are analyzed for their moments. The type of distribution of the output is also established. (Knapp-USGS)
W70-07905

2B. Precipitation

AN INVESTIGATION OF CLOUDS AND PRECIPITATION FOR THE TEXAS HIGH PLAINS,
Texas Univ., Austin. Coll. of Engineering.
Donald R. Haragan.
Texas Water Development Board Report III, Mar 1970. 126 p, 30 fig, 18 tab, 25 ref, 4 append. Texas Water Development Board Grant IAC (68-69) - 175.

Descriptors: *Meteorology, *Synoptic analysis, *Texas, *Climatology, Clouds, Precipitation (Atmospheric), Droughts, Cloud seeding, Distribution patterns, Meteorological data, Weather data, Data collections.
Identifiers: High Plains (Texas).

A study of the relationship among cloudiness, precipitable water vapor, water vapor flux, stability and precipitation is presented for the Texas High Plains. A cloud census gives the annual and diurnal variations of cloud types and amounts in the area. The most common cloud types are altocumulus and cirrus. Total cloud cover is greatest during winter and least during fall. During periods of above normal rainfall, precipitation during late fall and winter is associated with stratiform clouds and cyclonic activity. Spring and summer precipitation is most highly correlated with cumuliform clouds. Periods of above normal precipitation in the plains area are associated with above normal cloud amounts, while dry periods are generally lacking in clouds. An exception is summer cumulus which occurs during both dry and wet periods. Wet periods are further characterized by atmospheric instability and above normal values of precipitable water vapor and water vapor transport. Dry periods are associated with atmospheric circulation patterns which either serve to cut off the supply of low-level moisture, produce subsidence and consequent atmospheric stability, or both. Occasionally, however, sufficient clouds are present during dry periods in conjunction with adequate supplies of precipitable water and the absence of upper level stability to hold promise for artificial cloud modification experiments. (Knapp-USGS)
W70-07655

THE DESIGN OF NOZZLE NETWORKS FOR THE SIMULATION OF RAINFALL,
Imperial Coll. of Science and Technology, London (England).
For primary bibliographic entry see Field 07A.
W70-07674

SOCIAL AND ECONOMIC IMPACT OF SNOW SURVEY DATA,
Soil Conservation Service, Boise, Idaho.
For primary bibliographic entry see Field 06B.
W70-07676

MONTANA TELEMETRY SYSTEM,
Soil Conservation Service, Bozeman, Mont.; and Montana State Univ., Bozeman. Dept. of Engineering.

For primary bibliographic entry see Field 07A.
W70-07678

A STUDY OF ARIDITY AND DROUGHTS AT VISAKHAPATNAM,
Andhra Univ., Waltair (India).
V. P. Subrahmanyam, and C. V. S. Sastri.
Annals of Arid Zone, Vol 8, No 1, p 18-22, Mar 1969. 5 fig, 2 tab, 4 ref.

Descriptors: *Water balance, *Droughts, *Arid climates, *Semi-arid climates, *Moisture deficit, Consumptive use, Hydrologic budget, Precipitation, Climatic data.
Identifiers: *India, *Aridity index.

Drought is a term of limited meaning involving a condition of water deficiency while aridity is a climatic term of wide connotation. The aridity index was developed for classification of climates and is the ratio of annual water deficit to annual water need. Yearly aridity indices for Visakhapatnam, India, were calculated for the years 1891-1965 according to a standard book-keeping procedure for water balance. The data indicate that drought intensities cannot be assessed purely on the basis of precipitation since water deficits do not necessarily vary with rainfall. It is concluded that disastrous droughts are the results not of total rainfall but of maldistribution of rainfall, and that drought duration is as crucial to water balance as drought intensity. (Casey-Arizona)
W70-07796

SOME ASPECTS OF WATER MANAGEMENT FOR CROP PRODUCTION IN ARID AND SEMIARID ZONE OF INDIA,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 03F.
W70-07797

A HYDROMETEOROLOGICAL STUDY RELATED TO THE DISTRIBUTION OF PRECIPITATION AND RUNOFF OVER SMALL DRAINAGE BASINS - URBAN VERSUS RURAL AREAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 04C.
W70-07980

THE CLIMATE OF CITIES,
William P. Lowry.
Scientific American, Vol. 217, No. 2, p. 15-24, August 1967. 14 fig.

Descriptors: *Precipitation (Atmospheric), *Air temperature, *Climates, Fog, Smoke, Humidity, Absorption, Solar radiation, Cloud cover.
Identifiers: *Heat isaldn, *Dust dome, Infrared photography, Thermograph.

The five basic reasons for the variations in climate between the cities and the countryside included: (1) Greater absorption of heat energy by surface materials in the city than in the countryside; (2) The greater variation in shapes and orientation of structures; (3) Increased number of particulates in the air above the city; (4) Extra generation of heat in the city; and (5) Distinctly different ways of disposing of precipitation, leading to less cooling. These basic influences apply to a city during the course of a day. As the sun comes up, slow circulation of air between the city and the suburbs occurs due to the reflection of rays and absorption of heat caused by the walls in the city. At midday little difference in temperature could be detected between the city and the suburbs. In the late afternoon, however, a marked difference was observed. At night, the suburbs cooled more rapidly. Other observed characteristics of the city included a 'dust dome,' a heat island, loss of sunlight, frequency of fogs, and increased precipitation. In summary, the variables of climate are profoundly affected by the physical characteristics and human activities of a city. Those living in the city have lower heating bills, fewer days with snow, and a longer gardening season. (Osborne-Vanderbilt)
W70-08121

MODELS OF PRECIPITATING CUMULUS TOWERS,
Environmental Science Services Administration, Miami, Fla. Atmospheric Physics and Chemistry Lab.
For primary bibliographic entry see Field 03B.
W70-08124

RECENT STUDIES OF URBAN EFFECTS ON PRECIPITATION IN THE UNITED STATES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 04C.
W70-08126

MOISTURE POLLUTION OF THE ATMOSPHERE BY COOLING TOWERS AND COOLING PONDS,
Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 05C.
W70-08128

2C. Snow, Ice, and Frost

FALLOUT AND CLIMATE STUDIES ON FIRN CORES FROM CARREFOUR, GREENLAND,
Innsbruck Univ. (Austria); and Copenhagen Univ. (Denmark). H. C. Orsted Inst.
For primary bibliographic entry see Field 05A.
W70-07667

2D. Evaporation and Transpiration

PRESENT DAY EVAPORATION MEASUREMENT TECHNIQUES,
Geological Survey, Denver, Colo.
G. Earl Harbeck, Jr., and J. Stuart Meyers.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7388, p 1381-1390, July 1970. 10 p, 2 fig, 1 tab, 14 ref, append.

Descriptors: *Reservoir evaporation, *Reservoirs, *Mass transfer, *Energy budget, Solar radiation, Water measurement, Costs, Evaporation, Water loss.
Identifiers: Falcon Reservoir (US-Mexico).

The energy-budget and mass-transfer methods are currently being used by the U.S. Geological Survey to measure evaporation from lakes and reservoirs. Because the field equipment is expensive and data processing and analysis are time consuming, the use of the energy-budget method is limited to those reservoirs where the need for detailed information warrants the expense.Ordinarily the mass-transfer coefficient for a selected reservoir is determined using the energy--budget method over a period of 15 months or longer. After this, the energy-budget equipment can be removed, and the mass-transfer method, which requires a minimum of equipment and office work, can be used to compute evaporation on a continuing basis. During 1965-67 a cooperative study by the International Boundary and Water Commission and the Geological Survey showed that evaporation from Falcon Reservoir on the Rio Grande was 189 cm and 167 cm for two successive years. (Knapp-USGS)
W70-07664

GENERAL CIRCULATION OF WATER MASSES IN THE RED SEA,
Woods Hole Oceanographic Institution, Mass.
G. Siedler.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 131-137, 1969. 7 p, 7 fig, 32 ref.

Descriptors: *Currents (Water), *Salinity, Density currents, Evaporation, Water temperature, Winds, Oceanography, Mapping, Climates, Arid lands.
Identifiers: *Red Sea.

A summary is given of the main features of the Red Sea circulation caused by evaporation and wind stress. Average temperature and salinity distributions are discussed, and some estimates of the water budget and water renewal times are calculated. (See also W70-07394). (Knapp-USGS)
W70-07684

EVAPORATION, POTENTIAL EVAPOTRANSPIRATION IN LEBANON, AND CALCULATED PICHE COEFFICIENT (IN FRENCH),
Food and Agriculture Organization of the United Nations, Tal-Amara (Lebanon); and Lebanon Agricultural Research Inst., Tal-Amara. Dept. of Irrigation Engineering.
S. Sarraf, N. Vink, and A. Aboukhaled.
English summary. Magnon, Serie Scientifique, Publication No 32, Dec 1969. 29 p, 6 fig, 5 tab, 4 append.

Descriptors: *Evaporation, *Evapotranspiration, Climatology, Irrigation, Irrigation effects, Lysimeters, Microenvironment, Evaporation pans, Arid lands, Semiarid climates.
Identifiers: *Potential evapotranspiration, *Lebanon.

Evaporation and potential evapotranspiration (PET) data were reported for the Coastal Plain and Central Bedaa Valley of Lebanon over the years 1966-1969. Evaporation and PET were measured at two stations in each area: Tal-Amara and Terbol (Central Bekaa) and Abde and Tyr (Coastal Plain). PET values were obtained in the Central Bekaa through the use of 4 square-meter and 0.26 square-meter drainage lysimeters. On a monthly basis, PET agreement between the two lysimeter sizes was good. Measured PET values from Tal-Amara exceeded those from Terbol by 10%. This was probably due to lack of irrigation near Tal-Amara as compared to extensive irrigation near Terbol. During the April-September irrigation seasons in 1968 and 1969, evaporation in the Central Bekaa exceeded evaporation on the Coast by 16% (calculated by the Penman method), 23% (sunken Colorado pan), and 33% (class A pan). For this same period measured PET was approximately 1100 mm in the Central Bekaa and 800 mm on the Coast. The authors suggested suing a seasonal alpha coefficient (Bouchet formula) of 0.34 for the Lebanese Coast and 0.26 for the irrigated lands in the Central Bekaa Valley. (Carr-Arizona)
W70-07768

A GENERALISED COMPUTER PROGRAM FOR THE SOLUTION OF THE PENMAN EQUATION FOR EVAPOTRANSPIRATION,
Aston Univ., Birmingham (England).
Thomas R E. Chidley, and John G. Pike.
Journal of Hydrology, Vol 10, No 1, p 75-89, Jan 1970. 15 p, 1 tab, 6 ref, 5 append.

Descriptors: *Evapotranspiration, *Consumptive use, Meteorological data, *Solutions, *Computer programs, *Computer programming, Hydrology.
Identifiers: *Penman equation, Potential evaporation, ALGOL, Water budget.

A generalized computer program that has a wide application with regard to location and variety of input data is given for solving the Penman equation for evapotranspiration. The form of output is designed to provide an immediate record of potential evaporation rates and a summary of the meteorological data used. The main elements of the Penman equation are in self-contained blocks, enabling changes to be made in some of the sections of the program to allow for more advanced methods. Possible lines of development of this program are: (1) More sophisticated procedures for computing the saturation vapor pressure and the slope of the saturation vapor pressure for differing

conditions. The formulas used in the program apply only to conditions over water at normal pressure. (2) From the point where the program begins to substitute the time-averaged data into the Penman equation, the whole program, excluding output, could be written as an ALGOL procedure, enabling the formula to be more readily incorporated within the body of other programs, such as water budget problems. (3) The aerodynamic term could be modified to include a wind term based on wind profile theory incorporating surface roughness to give more reliable estimates for short time periods. (USBR)
W70-07877

FOREST HYDROLOGY IN A KARSTIC REGION OF SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
J. W. Holmes, and J. S. Colville.
Journal of Hydrology, Vol 10, No 1, p 59-74, January 1970. 16 p, 9 fig, 3 tab, 4 ref.

Descriptors: *Evaporation, *Forests, *Pine trees, *Water balance, Solar radiation, Rainfall, Infiltration, Soil water, Groundwater, Water table, Recharge, Water level fluctuations, Water utilization, Consumptive use, Demonstration watersheds.
Identifiers: *Australia, Gambier Plain.

Evaporation was measured in two stands of Pinus radiata in southern Australia at a location of 141 deg E, 38 deg S. The predominantly winter rainfall of about 600 mm was almost all evaporated by early summer and therefore no recharge of the local aquifer, by deep infiltration, occurred beneath the forest. The evaporation from forest during winter and spring was up to 2.2 times that from grassland. There was no soil water stress during this period but an explanation is needed for the supply of energy used in forest evaporation. The forest albedo is less than that of the pasture but the extra radiation energy absorbed by the forest is insufficient to explain all the increase of evaporation. Advection of sensible heat from the neighboring grassland is sometimes sufficient to explain the greater evaporation from the forests. It is thought that subsidence of continental air masses supplies an appreciable component of the energy budget. Also, advection from the Southern Ocean may supply energy to this part of southern Australia during winter and early spring. (Knapp-USGS)
W70-07901

GRASSLAND HYDROLOGY IN A KARSTIC REGION OF SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
J. W. Holmes, and J. S. Colville.
Journal of Hydrology, Vol 10, No 1, p 38-58, January 1970. 21 p, 11 fig, 4 tab, 11 ref.

Descriptors: *Water requirements, *Irrigation water, *Hydrologic budget, *Grasslands, *Karst, Recharge, Evapotranspiration, Groundwater, Water table, Lysimeters, Nuclear mositure meters, Rainfall, Water utilization, Consumptive use, Water balance.
Identifiers: *Australia, Gambier Plain.

The water balance of grassland on the Gambier Plain, Australia, about 24 miles from the Southern Ocean, was investigated using lysimeters and neutron moisture meters. For the years 1961-1965, precipitation was 632 mm, evaporation was 588 mm, and underground drainage to a water table aquifer in Tertiary limestone was 63 mm. The balance item of -19 mm represents change in soil water content. The total recharge of the groundwater was estimated to be about 430,000 acre-feet per year from an area of 3 million hectares. The irrigation potential was assessed to be about 150,000 ha, from the annual recharge of the groundwater resource. In the highest rainfall region which has an area of 350,000 ha, about one quarter of the land could be irrigated by local groundwater. (Knapp-USGS)
W70-07902

ENVIRONMENTAL EFFECTS OF NUCLEAR COOLING FACILITIES,
Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
For primary bibliographic entry see Field 05C.
W70-08125

2E. Streamflow and Runoff

FREE SURFACE, VELOCITY GRADIENT FLOW PAST HEMISPHERE,
Utah State Univ., Logan. Dept. of Hydraulic Engineering; Colorado State Univ., Fort Collins. Dept. of Civil Engineering; and North Dakota Univ., Grand Forks. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-07657

FLOW ANALYSIS OF LARGE TRIANGULAR WEIR,
Agricultural Research Service, Chickasha, Okla.
For primary bibliographic entry see Field 07B.
W70-07660

EFFICIENCY OF AIR-ENTRAINING VORTEX FORMATION AT WATER INTAKE,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-07662

INCEPTION AND ENTRAINMENT IN SELF-AERATED FLOWS,
Indian Inst. of Science, Bangalore. Dept. of Civil and Hydraulic Engineering.
For primary bibliographic entry see Field 08B.
W70-07670

EXPERIMENT ON AN EFFLUENT DISCHARGING FROM A SLOT INTO STATIONARY OR SLOW MOVING FLUID OF GREATER DENSITY,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 08B.
W70-07672

STREAMFLOW FORECASTING, A VITAL ELEMENT IN WATER MANAGEMENT,
Bureau of Reclamation, Salt Lake City, Utah.
For primary bibliographic entry see Field 07B.
W70-07677

TRANSIENT AND ASYMPTOTIC BEHAVIOUR OF RESERVOIRS WITH NON-PERSISTENT SEASONAL INFLOWS,
Lancaster Univ., Bailrigg (England).
E. H. Lloyd.
Journal of Hydrology, Vol 10, No 3, p 243-258, April 1970. 16 p, 6 ref.

Descriptors: *Reservoir storage, *Mathematical models, *Stochastic processes, *Statistical models, Streamflow forecasting, Statistics, Reservoir yield, Reservoir operation, Markov processes.
Identifiers: Reservoir forecasting, Reservoir management.

A mathematical model for a reservoir system comprises stochastic inflow, storage, and outflow. It has been shown that, when one approximates the continuum of water quantity by discrete units, and continuous time by discrete epochs, the sequence of statistically independent inflows gives rise to a Markovian sequence of reservoir contents. A complete solution contains a time-dependent ('transient') term, involving the initial configuration of the reservoir, as well as a constant ('asymptotic') component, which is independent of the initial conditions. In order to facilitate the solution, the Langbein model has been further simplified by coarsening the subdivision of the reservoir to only three states - empty, half-full and completely full. (Knapp-USGS)
W70-07898

THE ESTIMATION OF RUNOFF FROM RAINFALL FOR NEW BRUNSWICK WATERSHEDS,
Nelson Basin Board, Regina (Saskatchewan); and New Brunswick Univ., Fredericton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W70-07904

RAINFALL-RUNOFF RELATIONSHIPS EXPRESSED BY DISTRIBUTION PARAMETERS,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W70-07905

A HYDROMETEOROLOGICAL STUDY RELATED TO THE DISTRIBUTION OF PRECIPITATION AND RUNOFF OVER SMALL DRAINAGE BASINS - URBAN VERSUS RURAL AREAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 04C.
W70-07980

2F. Groundwater

DYNAMICS OF AN ARIZONA TRAVERTINE-FORMING STREAM,
Arizona State Univ., Tempe.
Gerald A. Cole, and George L. Batchelder.
Journal of the Arizona Academy of Sciences, Vol 5, No 4, p 271-283, October 1968. 3 fig, 6 tab, 40 ref.

Descriptors: *Travertine, *Calcium carbonate, *Discharge measurements, *Surface-groundwater relationships, *Carbon dioxide, Calcite, Calcium compounds, Hardness (Water), Alkalinity, Hydrogen ion concentration, Water properties, Oxygen, Cations, Anions, Magnesium, Arizona.
Identifiers: *Limnocrene environments, *Montezuma well, Oxygen productivity, Total equivalents.

Waters leaving a limnocrene environment, Montezuma Well, Yavapai County, Arizona, were studied at 3 successive stations downstream from the well outlet in June and December, 1968. In all instances there was a loss of total millequivalents of principal ions per liter between stations I-III and II-III and a slight gain between stations I-II. Computed oxygen productivity was considered comparable to most eutrophic waters. About 90 percent of the free carbon dioxide was lost from the outlet to station III, in June, amounting to an average of 1.0 to 1.7 mg/liter/minute. In October the range was 1.6-1.7 mg/liter/minute. At stations II and III, the pH increased with carbon dioxide losses, amounting to 0.72 and 0.23 untis in June and 0.76 and 0.07 units in October. It was speculated that the free carbon dioxide content in incoming waters may be highly variable. Cl, Na, K, Mg and sulfate ions were constant at all stations. Microparticulate calcium carbonate caused differences in alkalinity and hardness figures, and a mean of 88.8 kilograms per day of calcium carbonate was deposited between stations II and III, or about 4 percent of the amount in the flow per hour. (Casey - Arizona)
W70-07781

GRASSLAND HYDROLOGY IN A KARSTIC REGION OF SOUTHERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Adelaide (Australia). Div. of Soils.
For primary bibliographic entry see Field 02D.
W70-07902

RELATION OF SEA WATER TO FRESH WATER IN CARBONATE ROCKS IN COASTAL AREAS, WITH SPECIAL REFERENCE TO FLORIDA, U.S.A., AND CEPHALONIA (KEPHALLINIA), GREECE,
Geological Survey, Washington, D.C.
V. T. Stringfield, and H. E. LeGrand.
Journal of Hydrology, Vol 9, No 4, p 387-404, December 1969. 18 p, 9 fig, 18 ref.

Descriptors: *Groundwater movement, *Saline water intrusion, *Karst, *Florida, Aquifers, Salinity, Sea water, Saline water systems, Sinks, Springs, Lakes, Density, Water circulation, Hydrogeology.
Identifiers: Cephalonia (Greece).

The principles controlling the equilibrium between the denser salty water and the lighter fresh water in coastal aquifers apply to carbonate as well as sand systems. However, under certain equilibrium conditions of fresh and salt water in parts of some carbonate aquifers unusual hydrologic phenomena result. Hydrologic conditions at Tarpon Springs, Florida, and Cephalonia, Greece, include deep vertical openings as sinkholes through a relatively impervious part of the aquifer system. In both cases the tops of the sinkholes or natural wells are exposed to sea water. At Tarpon Springs the dynamic equilibrium between salt water and fresh water fluctuates so that the flow of salt water from the spring to a lake 2 miles away is sometimes reversed. At Cephalonia, the head of fresh water does not exceed the head of salty water in the sinkholes; the flow of sea water into the aquifer, aided by a shallow channel from the sea, is continuous, and the water level in the sinkhole is continuously depressed below sea level. Both cases represent a partially confined U-tube system where water at the seaward, sinkhole end is denser than at the other end and where a low fresh-water head is less than the salt-water head. (Knapp-USGS)
W70-07906

U-234/U-238 DISEQUILIBRIUM AS AN AID TO HYDROLOGIC STUDY OF THE FLORIDAN AQUIFER,
Florida State Univ., Tallahassee. Dept. of Geology.
M. I. Kaufman, H. S. Rydell, and J. K. Osmond.
Journal of Hydrology, Vol 9, No 4, p 374-386, December 1969. 13 p, 7 fig, 1 tab, 23 ref. Project A-005-FLA.

Descriptors: *Tracking techniques, *Groundwater, *Florida, *Uranium radioisotopes, Tracers, Karst, Aquifers, Hydrogeology, Radioactivity techniques, Permeability, Groundwater movement, Water chemistry, Trace elements.
Identifiers: Floridan aquifer.

Investigation of the distribution and environmental disequilibrium patterns of naturally occurring uranium isotopes (U-234, U-238) in waters of the Floridan aquifer in north Florida, utilizing the analytical methods of isotope dilution and alpha-particle spectrometry, indicates that variations in isotopic activity ratios and concentrations are related to the regional hydrogeologic framework. Interpretation is possible in terms of regional permeability characteristics including the existence of hydrologic barriers, groundwater circulation patterns, sources of waters from various parts of the hydrologic environment, and areas of extensive Pleistocene leaching within the Floridan aquifer. (Knapp-USGS)
W70-07907

2G. Water in Soils

CHANGES IN SOIL NUTRIENT STATUS RESULTING FROM OVERGRAZING AND THEIR CONSEQUENCES IN PLANT COMMUNITIES OF SEMI-ARID AREAS,
University of New England, Armidale (Australia). Dept. of Botany
J. L. Charley, and S. W. Cowling
Proceedings of the Ecological Society of Australia, Vol 3, p 28-38, 1968. 3 fig, 6 tab, 30 ref

Descriptors: *Desert plants, *Cycling nutrients, *Essential nutrients, *Organic matter, Nitrogen, Phosphorus, On-site data collection, Soil-water-plant relationships, Nutrient requirements, Erosion, Arid lands, Biomass, Annual turnover, Productivity, Degradation (Decomposition).
Identifiers: *Australia, Degraded areas.

It is argued that limitation of essential nutrients and not water are the limiting factors in plant biomass in arid regions. Nitrogen content in the soil is largely a function of nodulating legumes and input is limited by active plant growth. Arid regions have less N than humid regions and Australia has less than other arid regions. Soil organic matter is low in deserts because sparse rainfall limits decay periods. Soil phosporus is little affected by climatic factors or natural input and is mainly governed by the P content of parent material. Soils at the lower end of the fertility spectrum show the greatest relative accumulation of nutrients near the surface and organic carbon, total N and available P and nitrate production fall away sharply with increasing depth. Measurements in a saltbush community showed that the total leaf and fruit litter fall for a year was greater than the weight of leaf held in the community, indicating a high recycling rate. In an overgrazed area with a soil truncation fo 10 cm due to erosion it was estimated that 35% of total circulating N, 45% of organic matter and greater than 22% of an already low P is lost. Efforts to furrow the area and eliminate grazing did not increase plant production. It was concluded that probably not lack of rainfall but low P limited N production and the whole system of nutrients is delicately balanced by a high recycling process which is easily disturbed. (Casey-Arizona)
W70-07761

HYDRAULIC CONDUCTIVITY AND CERTAIN SOIL CHARACTERISTICS OF SUBSOILS WITH SPECIAL REFERENCE TO DRAINAGE DESIGN IN THE ALLUVIAL SOILS OF U.A.R.,
Ain Shams Univ., Cairo (Egypt). Dept. of Soils.
Hassan Hamdi, Salah El Din Metwally, and Bishay Guindi.
Journal of Soil Science of the U.A.R., Vol 8, No 1, p 51-70, 1968. 4 tab, 13 ref.

Descriptors: *Hydraulic conductivity, *Drainage, *Groundwater movement, *Permeability, *Soil texture, Compaction, Fractures (Geology), Alluvium, Anion exchange, Cation adsorption, Electrical conductivity, Clays, Fine-textured soils, Sediments, Impermeability, On-site tests, Drilling, Soil surveys, Soil chemical properties, Soil physical properties, Drains, Data collections.
Identifiers: United Arab Republic.

The proper orientation and placement of drains relative to the most permeable layers of the soil profile is considered a function of hydraulic conductivity. Previously the hydraulic conductivities of alluvial soil in the U.A.R. were determined by studying soil texture. This study utilized the auger hole method, below the water table, to determine relationships between hydraulic conductivity and various soil characteristics: electrical conductivity, soluble anions, SAR, and exchangeable cations. None were found. Additionally, no apparent relationships between hydraulic conductivity and various textural fractions could be established. It was concluded that the hydraulic conductivity, for a given soil volume, is a function of various passageways for water, such as cleavages and fissures. These channels cannot be determined by textural analyses and it is therefore inadvisable to use textural characteristics alone as a criterion for drain spacing. Also, impermeable layers are probably the result of some interaction between: (1) A high percentage of fine clay combining with the high water table, causing stratification, and (2) Compression of deep layers by overlying surface layers resulting in less aeration. (Casey-Arizona)
W70-07762

CONTROL OF SOIL MOISTURE DURING SPRINKLER IRRIGATION,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering
For primary bibliographic entry see Field 03F.
W70-07769

MICROBIOLOGICAL PROBLEMS OF THE ARID ZONE,
Cornell Univ. Ithaca, N.Y. Lab. of Soil Microbiology.
For primary bibliographic entry see Field 03F.
W70-07779

THE ASSESSMENT OF SOIL WATER STATUS AS IT AFFECTS PLANT WATER USE,
National Vegetable Research Station, Wellesbourne (England).
For primary bibliographic entry see Field 02I.
W70-07799

THE QUANTITATIVE DESCRIPTION OF SOIL MOISTURE STATES IN NATURAL HABITATS WITH SPECIAL REFERENCE TO MOIST SOILS,
University Coll. of Wales, Aberystwyth.
V. I. Stewart, and W. A. Adams.
Measurement of Environmental Factors in Terrestrial Ecology, Blackwell Scientific Publications, p 161-173, 1968. 1 fig, 3 tab, 6 ref.

Descriptors: *Drainage, *Moisture content, *Soil water, *Porosity, *Soil moisture, Field capacity, Soil profiles, Soil horizons, Soil properties, Soil investigations, Soil water movements, Sampling, Pore sizes, Cores, Retention.
Identifiers: *pF values, *Waterlogged percentage, *Drainage state, *Gley characters, *Soil wetness measures, Sampling depth, Intact field cores, Soil retentivity, Moisture release curve, Site characteristics.

Pedologists assess drainage state on the basis of gley characters which are unsupported by any quantitative evidence relating significance for drainage to actual moisture states. In an effort to express difference in degree of soil wetness on an understandable comparative basis, several techniques are considered: (1) The most appropriate sampling occasions; (2) Measurement locale; (3) Sampling types; (4) Relevant concepts of wetness and the consequent required type of measurement. Sampling should be restricted to field capacity days and samples should be compared to standard samples from freely drained soil. Sampling should also be confined to clearly defined described horizons from which intact field cores of known volume are taken. Percentage pore space filled with water is considered the best parameter of soil wetness and should be described as 'percent waterlogged'. The pF value as a measure of soil moisture states is discussed and it is recommended that field cores be equilibrated at pF2 and weighed. A graph of percent waterlogged on field capacity day versus percent waterlogged at pF 2 then facilitates a distinction between horizons poorly drained because of site and horizons probably waterlogged because of retentivity. (Casey-Arizona)
W70-07800

COMPARISON OF METHODS FOR CALCULATING VERTICAL DRAINAGE AND INFILTRATION FOR SOILS,
Agricultural Research Service, Phoenix, Ariz.
Frank D. Whisler, and Herman Bouwer.
Journal of Hydrology, Vol 10, No 1, p 1-19, Jan 1970. 19 p, 13 fig, 1 tab, 20 ref.

Descriptors: *Drainage, *Infiltration, *Soils, Capillary conductivity, Soil water movement, Numerical analysis, Numerical method, Methodology, Equations, Porous media, Capillary tubes, Groundwater flow, Unsaturated flow, Hydraulic conductivity, Saturated flow, Bibliographies, Drainage engineering, Moisture uptake, Theoretical analysis.

Identifiers: *Comparative studies, Infiltration rate, Soil columns, Water absorption tests, Permeability tests.

The Youngs, Gardner, Ligon, and numerical analysis techniques for calculating the amounts of one-dimensional, vertical drainage from soil are discussed and compared with each other and with observed data. The same was done with the Green and Ampt, Philip, and numerical analysis methods for calculating the amounts of infiltration into soil profiles. The numerical analysis methods gave the best agreement with the observations, but required considerable input data, and the calculation procedure was not simple. The Youngs drainage equation and the Green and Ampt infiltration equation were the easiest to use, giving reasonably accurate results that are probably sufficient for most field problems. (USBR)
W70-07876

HYSTERESIS OF PORE WATER IN GRANULAR POROUS BODIES,
Agricultural Research Council, Cambridge (England).
A. Poulovassilis.
Soil Sciences, Vol 109, No 1, p 5-12, Jan 1970. 8 p, 10 fig, 1 tab, 5 ref.

Descriptors: *Hysteresis, *Porous materials, *Porous media, Wetting, *Granular materials, Sands, Hydraulic conductivity, Moisture content, Drying, Soil science, Soil engineering, Forecasting, Laboratory tests.
Identifiers: Suction, *Pore water, Soil columns, Soil suction.

Experimental results concerning the hysteresis behavior of granular porous bodies are compared with the predictions of the independent domain concept. A dynamic method is described for the direct determination of the relationships between moisture content and suction and moisture content and hydraulic conductivity on long vertical columns. Some experimental results concerning the hysteresis of the hydraulic conductivity are reported. To achieve the desired results, it was necessary to devise a method of stabilizing the geometry of a granular porous body, over long periods and over many reversals of wetting and drying, more generally applicable than in sintering. The method adopted was to work with deep columns of material and to stabilize the geometry by overburden pressure. (USBR)
W70-07878

2H. Lakes

STRATIFICATION OF FLOW FROM CHANNEL INTO DEEP LAKE,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
Heinz Stefan.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7401, p 1417-1434, July 1970. 18 p, 10 fig, 8 ref, append.

Descriptors: *Stratified flow, *Heated water, *Thermal powerplants, *Outlets, *Hydraulic models, Thermal pollution, Lakes, Oceans, Model studies, Discharge (Water), Thermal stratification, Density stratification, Outlet works, Cooling water, Open channel flow, Reservoirs, Water temperature, Water quality, Water quality control, Water pollution control.
Identifiers: Thermal discharges.

The flow of heated water from an open channel into a reservoir containing colder and essentially stagnant water was studied in a laboratory flume. The basic mechanisms studied can produce a variety of substantially different flow patterns. The combined effects of buoyancy, viscosity, and stratification conditions in the reservoir on the flow are shown qualitatively in the case of a two-layered system. The information obtained may be used to design and operate heated water outlets and outfalls in lakes and oceans. (Knapp-USGS)
W70-07661

SIZE OF CENTRIC DIATOMS AS AN ECOLOGICAL INDICATOR,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
Ramon Margalef.
Mitteilungen Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 202-210, 1969. 4 fig, 1 tab, 16 ref.

Descriptors: *Diatoms, *Ecology, *Indicators, *Lakes, Size, Temperature, Salinity, Nutrients, Sediments, Seasonal, Zooplankton, Environmental effects.
Identifiers: *Centric diatoms, Skeletonema, Melosira arenaria, Melosira sulcata, Italy, Vigo Bay (Spain), Polymorphic, Coscinodiscus nodulifer, Woods Hole (Mass), Pyrenees, Fossil lake, Cyclotella bodanica, Stephanodiscus, Cyclotella comensis, Fragilaria crotonensis, Lake Maggiore (Italy), Lake Mergozzo (Italy), Size fluctuations.

Some published information is reviewed and new evidence presented concerning diatoms of the Italian lakes. Distribution of Melosira sulcata suggests that environmental influence on populations may act through differential selection of discrete morphs and through phenogenetic reaction of the cells in each morph. The data from Vigo Bay (Spain) suggest that salinity influences size of Melosira sulcata, and, under lowered salinity, higher diameters are more common. Nutrient concentration is probably also relevant. Observation of present and past sediments point to association between larger diameter of frustules and highly productive water in recent sediments, or a higher content of plant pigments in older ones. A large species of Stephanodiscus was common in certain periods of the lake's existence and exhibited, like other diatoms, insignificant differences in the average diameter. It is tentatively suggested that a notable fluctuation in size may be due to seasonal changes in water temperature and that, as today, frustules sedimented in summer are on the average thinner than those deposited in colder seasons. Specimens of Cyclotella bodanica were measured from two small cores of sediment from Lago Maggiore and Lago di Mergozzo suitable for checking changes of size with time. (Jones-Wisconsin)
W70-08099

AQUATIC PLANT SURVEY OF MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED,
Wisconsin Dept. of Natural Resources, Madison.
Richard F. Modlin.
Department of Natural Resources, Madison, Wisconsin, Research Report No 52, 1970. 45 p, 1 fig, 4 tab, 10 ref, 17 photos.

Descriptors: *Aquatic plants, *Surveys, *Lakes, *Wisconsin, Watersheds (Basins), Chara, Cattails, Bulrush, Sago pondweed, Sampling, Water quality, Geographical regions, Geology, Limnology, Bottom sediments, Fertility, Weed control.
Identifiers: *Milwaukee River (Wis), Typha, Scirpus validus, Potamogeton pectinatus, Nymphaea tuberosa, Chara, Nuisance growths, Myriophyllum, Sagittaria, Anacharis, Najas, Lemna, Eleocharis, Carex, Ceratophyllum, Cyperus, Sparganium, Acorus, Asolepias, Brasenia, Caltha, Decodon, Equisetum.

Twenty-three lakes of the Milwaulkee River watershed were surveyed from June to September 1968, to record aquatic vegetation abundance and species composition; 39 genera and 61 species were identified. The greatest variety recorded in any single lake was 24 genera and 34 species. Stonewort (Chara), cattail (Typha), softstem bulrush (Scirpus validus), sago pondweed (Potamogeton pectinatus), and while water lily (Nymphaea tuberosa) occurred most extensively and in greatest abundance. Some variations in abundance and dominance were noticed over the summer. Marl lakes of the northeast basin and the tea-colored lakes of the northwest basin contained a very small biomass and scattered plant distribution, while the other lakes had a very large biomass and continuous distribution of plants. The importance of lake vegetation cannot be minimized but overabundance of any specie will interfere with lake usage. Enrichment, pollution, and other unnatural conditions may trigger prolification. Some shorelines could be improved by encouraging growth of specific emergent and floating aquatics. Arrowheads, milkweed, water lilies, and pickerelweed flower throughout most of the summer, adding color to a lakeshore. Such improvements would be especially important on lakes in or near metropolitan areas. (Jones-Wisconsin)
W70-08104

THE NEWEST DEVELOPMENT IN LAKE LUCERNE (IN GERMAN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
H. Ambuhl.
English summary.

Descriptors: *Lakes, *Oxygen, Phosphorus, Nitrogen, Stratification, Winds, Eutrophication, Fertilization, Oligotrophy, Primary productivity.
Identifiers: Oxygen consumption, Lake Lucerne, Kreutztricher, Obermatt, Gersauer See, Urnersee.

Limnological investigations, conducted during the last 9 years, disclosed the highest oxygen consumption in the oligotrophic part of the lake, exposed to the most intensive mixing by strong and persistent winds. During the past 5 years, the annual average of total phosphorus was doubled, and the nitrate content increased in the last 7 years from 0.34 to 45 milligram/liter nitrogen. Fertilizing experiments, employing plastic bags, have indicated that phosphorus is the most important growth-limiting factor, responsible for the increase of eutrophication and primary production. (Wilde-Wisconsin)
W70-08106

2I. Water in Plants

SOIL-PLANT RELATIONSHIPS OF TWO STEPPE DESERT SHRUBS,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
W. H. Rickard, and R. F. Keough.
Plant and Soil, Vol 29, No 2, p 205-212, Oct 1968. 1 fig, 5 tab, 8 ref.

Descriptors: *Deserts, *Desert plants, *Shrubs, *Plant physiology, *Cation exchange, Zerophytes, Arid lands, Soil-water-plant relationships, Washington, Soil profiles, Soil chemical properties, Potassium, Sodium, Leaves, On-site investigations.
Identifiers: *Leaf litter.

An eastern Washington plant community in which the dominant shrubs are hopsage (Grayia spinosa) and greasewood (Sarcobatus vermiculatus) was studied to determine the effects of the plants on soil properties. Leaves and surface soil were analyzed for cationic and moisture contents. The leaf ash content, Na content and moisture were greater in greasewood leaves while K content was greater in hopsage leaves. With age the predominant cation of each species increased. The soil beneath the canopy of a plant showed a greater content of the predominant cation of that species than adjacent soil areas. Cheatgrass (Bromus tectorum) beneath greasewood had greater Na contents than cheatgrass growing in other areas, indicating it was taking up Na formerly incorporated in greasewood leaves. The chemical properties of the soil profile show increasing pH, exchangeable Na percentage and conductivity below 4 dm depths, and greater exchangeable K above 4 dm depths. It was concluded that the soil areas around these shrubs are being supplied with increments of K and Na faster than the low rainfall regime can leach them out. The significance of this in terms of the future of the plant community is unknown. (Casey-Arizona)
W70-07757

THE BIOLOGY OF THE LARKS (ALAUDIDAE) OF THE KALAHARI SANDVELD,
Cornell Univ., Ithaca, N.Y. Dept. of Ecology and Systematics.
G. L. Maclean.
Zoologica Africana, Vol 5, No 1, p 7-39, Mar 1970. 19 fig, 6 tab, 64 ref.

Descriptors: *Xerophilic animals, *Deserts, *Birds, *Nests, *Reproduction, Non-migratory birds, Non-game birds, Bird eggs, Clutch, Bird types, Vegetation, Precipitation, Arid lands, On-site investigation, Dunes, River beds, Breeding, Ecosystems, Calcium carbonate.
Identifiers: *Kalahari sandveld, *Nomadic birds, *Larks, *Calcrete, Feeding habits, South Africa.

Of all passerine birds the larks have shown the greatest degree of adaptive radiation in the arid regions of the Old World. This paper examines their ecology in the Kalahari sandveld, where mean annual rainfall predominately summer, is 226 mm and the yearly temperature range is -11 degrees C to 40 degrees C. Nomadic birds occur in various arid regions including the Kalahari and move over wide areas following weather conditions and other favorable environmental variables. Eight breeding species and one non-breeding species, both non-nomadic and nomadic, were described. Red larks live in dunes and grey larks on the calcrete. There is ecological separation in both areas by small differences in vegetation cover. All non-nomadic species were insectivorous which is a great water conservation advantage in arid lands. The nomadic species were all granivorous. Gradations in bill shapes indicated overlapping in feeding habits between insectivorous and granivorous birds. Breeding in all species was initiated by rainfall of at least 20 mm per month. Populations of nomadic species usually increased in breeding periods. The orientation of most nests was towards the east, southeast, or south, at the bases of bushes, insuring maximal protection from the sun. Breeding success averaged 17.9 percent for the family. (Casey-Arizona)
W70-07759

CHANGES IN SOIL NUTRIENT STATUS RESULTING FROM OVERGRAZING AND THEIR CONSEQUENCES IN PLANT COMMUNITIES OF SEMI-ARID AREAS,
University of New England, Armidale (Australia). Dept. of Botany.
For primary bibliographic entry see Field 02G.
W70-07761

BIOMASS OF DESERT WINTER ANNUAL PLANT POPULATIONS IN SOUTHERN NEVADA,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
Janice C. Beatley.
Oikos, Vol 20, No 2, p 261-273, 1969. 3 fig, 2 tab, 12 ref.

Descriptors: *Deserts, *Desert plants, *Plant growth, *Productivity, *Biomass, Xerophytes, Arid lands, Arid climates, Growth stages, Mature growth stage, Vegetation establishment, Soil-water-plant relationships, Life cycles, Precipitation (Atmospheric), Nevada, Shrubs.
Identifiers: *Primary productivity, *Annuals, *Mojave desert, *Great Basin desert, Transition zone, Disturbed site.

In an effort to assess desert ecosystem primary productivity, the biomass of reproductively mature annuals was measured in a region including the Mojave Desert, the Great Basin Desert, and a transitional region. Sixty-eight separate sites, representing the principal kinds of ecosystems in 8 drainage basins, were studied during three successive spring growing seasons. Precipitation, edaphic variables, dominant shrubs and site disturbances were also studied in an effort to relate them to productivity. During the study period, extremes of germination success, growing season length, and density and size of individual plants were seen. Population distributions were so variable that in nearly two-thirds of the 203 sets of samples the mean dry weight of 20 samples/set was less than the standard deviation. Distribution at germination is a site characteristic and subsequent seedling distribution depends upon survival patterns, not absolute numbers. Year to year variations were great and not correlated with dominant shrub species or growing season lengths but were directly or indirectly related to rainfall. Burned sites were collectively 1.6-11 times as productive as undisturbed sites during the study period. Biomass over the three seasons was greatest in Mojave Desert communities, least in Great Basin communities. (Casey-Arizona)
W70-07763

CARBON DIOXIDE EXCHANGE OF SEEDLING PINES IN THE LABORATORY AS RELATED TO LOWER ELEVATION LIMITS,
Redlands Univ., Calif. Dept. of Biology.
R. D. Wright.
American Midland Naturalist, Vol 83, No 1, p 291-300, 1970. 3 fig, 3 tab, 15 ref.

Descriptors: *Elevation, *Photosynthesis, *Carbon dioxide, *Pine trees, *Drought tolerance, Plant physiology, Plant growth, Root development, Moisture stress, Photoactivation, Leaves, Soil-water-plant relationships, Arid lands, Thermal stress, Light intensity, Chaparral, Trees, California, Greenhouses.
Identifiers: *Elevational adaptations.

Three species of pine, P. attenuata (knobcone pine), P. coulteri (coulter pine) and P. lambertiana (sugar pine) were studied in an effort to determine adaptations relevent to the minimum elevations in their ranges. The former are trees of open chaparral while sugar pine occurs at higher elevations. Gross and net photosynthesis, under differing experimental conditions, were indirectly determined by measuring carbon dioxide exchange. Knobcone and coulter pines demonstrated lower photosynthetic efficiency in reduced light. Sugar pine produces both primary and secondary leaves in its first growth year while the others produce only primary leaves, whose photosynthetic efficiency was much greater, over a wide temperature range, than that of secondary leaves. This might account for greater early root growth in knobcone and coulter pines who also showed more photosynthesis during low temperature acclimation. This was interpreted as a gradient of decreasing drought avoidance since they are better able to utilize light during colder periods when moisture levels are higher at low elevations. Sugar pine was also less resistant to soil water stress. The ramifications of continued chaparral fire control on the future range extensions of knobcone and coulter pines are discussed. (Casey-Arizona)
W70-07764

MEASURED AND ESTIMATED WATER USE BY A CITRUS AND AN APPLE ORCHARD,
Food and Agriculture Organization of the United Nations, Tal-Amara (Lebanon); and Lebanon Agricultural Research Inst., Tal-Amara. Dept. of Irrigation Engineering.
For primary bibliographic entry see Field 03F.
W70-07767

WATER STRESS AND APICAL MORPHOGENESIS IN BARLEY,
Adelaide Univ. (Australia). Waite Agricultural Research Inst.
I. Husain, and D. Aspinall.
Annals of Botany, NS, Vol 34, No 135, p 393-407, March 1970. 6 fig, 7 tab, 19 ref.

Descriptors: *Moisture stress, *Plant physiology, *Barley, *Soil-water-plant relationships, *Plant growth, Soil moisture, Soil water, Moisture deficit, Moisture content, Water requirements, Leaves, Turgidity, Drought tolerance, Drought resistance, Photoperiodism, Light, Light intensity, Crop response.
Identifiers: *Apical meristem, *Morphogenesis, *Soil water potential, *Primordia, Plant response, Spikelets.

Levels of soil water potential (-1 bar and less) which had little effect on barley plant growth inhibited the formation of new primordia on the apical meristem. Even at water potential levels which completely suppressed primordium formation, leaf growth and morphogenesis of lateral spikelets on the developing ear proceeded at reduced rates. Changes in water potential in apical tissues apparently were not the cause of apex stress sensitivity, because primordium formation was inhibited even when apical water potential was unchanged. This sensitivity of the apex to stress did not appear to be affected by floral initiation. When the plant was exposed to an increased photoperiod, water stress suppressed response by the apical meristem. However, when stress was relieved there were some instances of delayed photo-periodic response. Rate of primordium formation rose in response to an increase in light intensity when water stress was at moderate levels. (Carr - Arizona)
W70-07770

GERMINATION REQUIREMENTS OF THE DESERT SHRUB LARREA DIVARICATA,
Duke Univ., Durham, N.C. Dept. of Botany.
Michael G. Barbour.
Ecology, Vol 49, No 5, p 915-923, Late Summer 1968. 5 fig, 5 tab, 24 ref.

Descriptors: *Germination, *Seeds, *Plant growth, *Desert plants, *Environmental effects, Environment, Habitats, Deserts, Arid lands, Arid climates, Xerophytes, Plant physiology, Sites, Reproduction, Seed treatment, Growth stages, Root development, Temperature, Sodium chloride, Osmotic pressure, Light, Soil-water-plant relationships, Water requirements, Soil moisture, Mortality.
Identifiers: *Creosotebush, Sonoran Desert, Mojave Desert, Chihuahuan Desert, Survival, Darkness.

Creosotebush seeds for use in laboratory studies of germination requirements were collected from 34 sites in 3 desert regions of the United States. Listed in order of increasing aridity, the 3 deserts were the Chihuahuan, Sonoran, and Mojave. Although no regional differences in germination behavior were found, optimum laboratory conditions for creosotebush germination included: darkness, temperatures of 23 deg. C, leaching of mericarps with running water, wetting and drying cycles, cold temperature exposure prior to sowing, low NaCl and near-zero osmotic pressure in the sand medium. Maximum root growth occured at 29 degrees C, slightly acidic medium, low NaCl, and near-zero osmotic pressure. Germination was markedly reduced when seeds were exposed to warm temperatures (37-71 degrees C) prior to sowing. Under optimum greenhouse conditions only 20 seedlings survived for every 100 mericarps sown at the beginning of the 6-month period. Mortality is probably much higher under natural conditions. (Carr - Arizona)
W70-07772

THE PERFORMANCE OF THREE TYPES OF LEAF-WETNESS RECORDERS,
Israel Meteorological Service, Bet-Dagan. Agrometeorological Div.
J. Lomas, and Y. Shashoua.
Agricultural Meteorology, Vol 7, No 2, p 159-166, March 1970. 5 tab, 11 ref.

Descriptors: *Moisture, *Dew, *Leaves, *Measurement, *Equipment, Instrumentation, Performance, Semiarid climates, Humidity, Condensation, Air environment, Meteorology, Plants, Plant pathology, Time, Environmental effects, Environment, Research equipment.
Identifiers: *Leaf wetness, *Dew recorders, Israel, Relative humidity, Standard meteorological screen.

Duration of relative humidity (85 percent and above) in a standard meteorological screen was

compared with duration of leaf wetness recorded by freelyyexposed field instruments and Taylor instruments located within a crop canopy. Resulting data suggest that direct measurement within the crop is the only accurate method of determining duration of leaf wetness. Taylor-type leaf-wetness recorders were found to be suitable for this purpose. One reason for the interest in leaf wetness is that in semiarid climates duration of dew may be an important factor influencing outbreaks of plant diseases. (Carr - Arizona)
W70-07774

WATER RELATIONS OF THREE WARM DESERT SPECIES,
Nevada Univ., Reno. Desert Research Inst.; and Utah State Univ., Logan. Coll. of Natural Resources.
N. Stark, and L. D. Love.
Israel Journal of Botany, Vol 18, No 4, p 175-190, 1969. 8 fig, 1 tab, 18 ref. OWRR Project A-023-NEV.

Descriptors: *Moisture availability, *Distillation, *Condensation, *Soil water movement, *Evapotranspiration, Soil-water-plant relationships, California, Soil texture, Porosity, Soil types, Soil temperature, Dew, Frost, Climatology, Evaporation, Precipitation, Arid lands, On-site investigations, Phenology, Leaves.
Identifiers: *Death valley, *Relative saturation percentage, *Plant moisture content, Leaf parenchyma, Creosote bush, Pigmycedar, Desertholly, Hygrothermograph.

An area in Death Valley with dry air, persistent winds, low water table and 2-8 centimeters of rain annually, was studied in an effort to determine the sources of water available to plants and the abilities of three species, Atriplex hymenelytra (desertholly), Larrea divaricata (Creosote bush) and Peucephyllum schottii (Pigmycedar) to utilize them. Precipitation, aerial moisture, soil water, and distillation were considered potentially available water sources, and evaporation transpiration, and deep seepage, sources of water loss. Climatic, soil moisture, plant moisture content and transpiration data were obtained and correlated. During periods of higher rainfall deep soil moisture increased and was subsequently depleted at temperatures of less than 36-40 degrees centigrade by delivery to the surface soil through distillation and condensation on the undersides of larger rocks near the surface of the coarse soil. Above the hygroscopic level absolute soil moisture was not as important as water delivered by distillation, which was determined to compensate for loss through transpiration. Surface evaporation losses were insignificant, except shortly after rains, while transpiration rates varied with seasonal fluctuations in the plant water status. Larrea showed the greatest physiological adjustment capabilities to low water content and frost, Peucephyllum, the least. Whether the plants utilized aerial moisture was not definitely determined. (Casey - Arizona)
W70-07775

PHYSIOLOGICAL ASPECTS OF DROUGHT DORMANCY IN GRASSES,
University of New England, Armidale (Australia). Dept. of Botany.
R. D. B. Whalley, and A. A. Davidson.
Proceedings of the Ecological Society of Australia, Vol 3, p 17-20, 1968. 1 fig, 3 ref.

Descriptors: *Plant physiology, *Desert plants, *Grasses, Vegetation, Arid lands, Soil-water-plant relationships, Xerophytes, On-site data collection, Plant growth.
Identifiers: *Dormancy, *Soil moisture stress, Reserve carbohydrates, Australia.

Dormancy in plants is characterized by growth cessation and specific adaptive physiological and structural changes. Plants of arid and semiarid climates often show the same growth and structural changes during periods of water stress and it is speculated that this condition is identical to dormancy. Seasonal dormancy of perennial grasses in humid environments show an increase in carbohydrate reserves in stem base and rhizome, and a decrease following renewed growth. Three species of perennial grasses native to a semi-arid area were regularly analyzed during the growing season for carbohydrates and this was correlated with soil moisture changes. It was found that reserve carbohydrate contents fluctuated the same way between soil moisture stress and rainfall as they do between dormancy and renewed growth. It was concluded that the reactions to soil moisture stress constituted true dormancy and was speculated that the physiological mechanisms are probably similar to those of photoperiod and thermoperiod-induced dormancy. (Casey - Arizona)
W70-07776

THE EFFECT OF SALINITY ON PERMEABILITY OF ROOTS TO WATER,
Arizona Univ., Tucson. Dept. of Biological Sciences; and Arizona Univ., Tucson. Environmental Research Lab.
J. W. O'Leary.
Israel Journal of Botany, Vol 18, No 1, p 1-9, 1969. 2 fig, 2 tab, 29 ref.

Descriptors: *Soil-water-plant relationships, *Root systems, *Osmotic pressure, *Water balance, *Salt tolerance, Turgidity, Permeability, Conductivity, Flow resistance, Biological properties, Resistance networks, Irrigation practices, Irrigation effects, Plant physiology.
Identifiers: *Plant water potential, *Relative water content, *Plant cell permeability, Salt water irrigation.

It was formerly thought that the osmotic pressure of cells of leaves and roots increased as the osmotic pressure of the solution around the roots increased. With constant turgor pressure there would be a corresponding adjustment of the plant water potential, maintaining a relatively constant plant water status. This theory was tested by starting kidney bean seedlings in nutrient solutions and transferring some to solutions of differing salinities. Root permeabilities were subsequently measured in pressure chambers. Water flow rate under pressure was much greater through roots of control plants than through those from saline solutions. The plants grown in saline solutions also showed greater leaf resistance to water vapor diffusion. The water status of the plants was determined by measuring relative water content (RWC) of primary and trifoliate leaves. The primary leaves did not differ in RWC but that of trifoliate leaves decreased with increasing salinity. It was concluded that root permeability decreases during growth in saline solutions and that this causes a great enough reduction of water delivery to the leaves resulting in decreased turgor. This is a form of physiological drought, and implies that irrigation with saline water would be most successful in areas of high humidity. Some methods of overcoming this problem in dry, arid areas are suggested. (Casey - Arizona)
W70-07777

DROUGHT RESISTANCE OF MONTEREY PINE NEEDLES,
Hebrew Univ., Jerusalem (Israel). Dept of Plant Physiology.
H. R. Oppenheimer.
Israel Journal of Botany, Vol 17, No 3, p 163-168, 1968. 1 fig, 3 tab, 14 ref.

Descriptors: *Plant physiology, *Pine trees, *Drought resistance, *Cuticle, *Stomata, Drought tolerance, Soil-water-plant relationships, Moisture deficit, Forced drying, Dehydration, Water requirements.
Identifiers: *Drought avoidance, *Stomatal closure, *Initial damage point, Israel.

Mature needle fascicles of Pinus radiata Don (Monterey pine) from the flushes of the three most recent years were subjected to slow dessication to determine drought resistance capabilities. Transpiration curves indicated a significantly inverse relationship between age and water deficit after 4 days. The initial damage point was reached at a water deficit of only 25 percent showing extreme susceptibility to dehydration. Since stomatal closure in excised needles occurred within 4 hours, subsequent water losses were considered cuticular and restriction of water loss in this phase did not prevent cell damage and early death. These results were compared with those obtained earlier from two more drought-resistant species, P. halepensis and P. pinea. It was concluded that differences in leaf drought resistance are mainly due to weaker leaf cutization in P. radiata, resulting in greater water loss per unit time. Drought tolerance was essentially the same in all three species indicating it is probably a generic property. The general phenomenon of increased transpiration in dying leaves was discussed. (Casey - Arizona)
W70-07780

ESTIMATION OF WATER STRESSES IN THE ROOT ZONE BY THE DOUBLE-ROOT SYSTEM TECHNIQUE,
Tel Aviv Univ. (Israel). Dept. of Botany.
Y. Waisel, and G. Pollak.
Israel Journal of Botany, Vol 18, No 3, p 123-128, 1969. 2 tab, 2 fig, 15 ref.

Descriptors: *Halophytes, *Wilting point, *Soil-water-plant relationships, *Osmotic pressure, Wilting, Transpiration, Moisture deficit, Plant physiology, Root zone, Moisture content, Circulation (Plants), Water balance.
Identifiers: *Water stress, *Split-root technique, *Adventitious roots, Israel, Non-wilting plants.

The water potentials in different plant organs may vary, but under steady state conditions will reach specific, stable, and related levels. Since halophytic plants in native habitats are subject to variable water stress in the active root zone, it would be useful to determine these stresses utilizing aboveground plant organs. Glass tubes were used as sleeves around the stems of potted plants. They were packed with heavy clay type soil, usually wetted, and sealed at both ends. Sunflowers developed adventitious roots in the sleeves; wilting points were determined by both direct and indirect methods, yielding identical results. Additionally, similar results were obtained with the sleeve technique using a halophytic, non-wilting species, Aeluropus litoralis. Aeluropus grown in nutrient solutions of differing NaCl and magnesium sulfate concentrations showed almost linear relationships between the salt concentrations and the water stress in the sleeved soil. Stressed plants grown under low and normal transpiration conditions showed similar sleeve water contents. It was concluded that water stresses of the soil around adventitious root systemsreflect those around the main root system and that this is due to osmotic adaptation in the auxiliary roots and is independent of temporary water stresses. (Casey - Arizona)
W70-07782

USE OF SOIL, WATER AND LEAF ANALYSES IN GROWING ORANGES IN JORDAN,
Ministry of Agriculture Amman, (Jordan). Research Dept.
For primary bibliographic entry see Field 03F.
W70-07784

GENETIC VARIABILITY IN ROOT DEVELOPMENT IN RELATION TO DROUGHT TOLERANCE IN SPRING WHEATS,
Sydney Univ., Narrabri (Australia). North West Wheat Research Inst.
For primary bibliographic entry see Field 3F.
W70-07785

CARROT POPULATION DENSITY AND YIELD IN AN ARID ENVIRONMENT,
California Univ., Davis. Dept. of Water Science and Engineering.

For primary bibliographic entry see Field 03F.
W70-07787

WATER RELATIONS OF BEANS; II. EFFECTS OF DIFFERENTIAL IRRIGATION ON YIELD AND SEED SIZE OF BROAD BEANS,
Khartoum Univ. (Sudan). Dept. of Agronomy.
For primary bibliographic entry see Field 03F.
W70-07788

EFFECT OF PLANT DENSITY AND GROWTH DURATION ON GRAIN SORGHUM YIELD UNDER LIMITED WATER SUPPLY,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 03F.
W70-07789

SOME EFFECTS OF SOIL MOISTURE STRESS ON THE GROWTH OF WHEAT (TRITICUM AESTIVUM L. EM THELL.),
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 03F.
W70-07790

ABSORPTION OF NA, CL, AND B BY DESERT SALTBUSH IN RELATION TO COMPOSITION OF NUTRIENT SOLUTION CULTURE,
California Univ., Riverside.
N. Jerry Chatterton, C. M. McKell, F. T. Bingham, and W. J. Clawson.
Agronomy Journal, Vol 62, No 3, p 351-352, May-June 1970. 2 fig, 1 tab, 6 ref.

Descriptors: *Absorption, *Salt tolerance, *Plant tissues, *Leaves, *Desert plants, Deserts, Arid lands, Environment, California, Sodium, Chlorine, Boron, Salts, Salinity, Chlorides, Inorganic compounds, Cultures, Ions, Halophytes, Plant morphology, Structure.
Identifiers: *Saltbush, *Trichomes, Mesophyll cells, Osmotic potential, Selective absorption.

Salt of tolerance of desert saltbush (Atriplex polycarpa (Torr.) S. Wats.) was thought to be related to its leaf anatomy. Therefore, experiments were conducted to study saltbush absorption of Na, Cl, and B in relation to concentration of these elements in water cultures. Plants were grown in NaCl solution cultures with osmotic potentials of -0.8, -10.0, -20.0, and -30.0 atm. Ten and 13% of Na and Cl, respectively, were found in the plants grown at -30.0 atm. Although large amounts of Na and Cl were accumulated in saltbush tissues, salt tolerance may be due to localization of salt in trichomes from adjacent mesophyll cells. This would reduce salt stress within photosynthetically active tissues. In the case of B, a selectivity mechanism operative in the roots reduces its absorption by saltbush and results in less B uptake than is common with many other plants. (Carr-Arizona)
W70-07791

EFFECTS OF SEEDING RATE AND ROW SPACING ON ESTABLISHMENT AND YIELD OF CRESTED WHEATGRASS,
Agricultural Research Service, Fort Collins, Colo. Crops Research Div.; and Colorado Agricultural Experiment Station, Fort Collins.
For primary bibliographic entry see Field 03F.
W70-07792

THE ROLE OF ROOT CYTOKININS DURING WATER AND SALINITY STRESS,
Negev Inst. for Arid Zone Research, Beersheba (Israel). Dept. of Plant Physiology.
C. Itai, A. Richmond, and Y. Vaadia.
U.S. Department of Agriculture Grant FG-1s-232.
Israel Journal of Botany, Vol 17, No 4, p 187-195, 1968. 2 fig, 3 tab, 24 ref.

Descriptors: *Plant growth regulators, *Moisture stress, *Osmosis, *Root zone, *Salt tolerance, Salinity, Osmotic pressure, Irrigation effects, Soil-water-plant relationships, Plant physiology, Leaves, Stemflow, Inhibitors, Environmental effects, Drought resistance, Water balance, Circulation (Plants).
Identifiers: *Cytokinins, *Protein synthesis, Mannitol, Carbowax 6000, Kinetin equivalents, Israel.

The growth reduction effects on plants, of salinity and drought have never been adequately explained although many theories have been proposed. Previous work indicated that cytokinins are produced in the roots, possibly regulate shoot growth, and are inhibited by water stress. Five week-old seedlings were subjected to stress by adding NaCl, Carbowax 6000, or mannitol to their nutrient solutions in 2 equal portions over 48 hours. The full stress was terminated after 24 hours. Root exudates were then assayed for cytokinin activity, and the active extract showed proportional decreases in callus growth with increasing dilution. The cytokinin activity in the extract also decreased linearly with increasing NaCl in the nutrient solution. Similar variations with Carbowax 6000 or mannitol indicated this was not an osmotic or specific ionic effect. Increase of NaCl also decreased L-leucine carbon 14 incorporation into leaf discs indicating salt-induced decrease in leaf protein synthesis resulted from cytokinin deficiency. Cytokinin levels rose after termination of stress. The thesis that cytokinin signals root stresses to the shoot causing decreased plant growth even at very low stress levels was considered probable. (Casey-Arizona)
W70-07798

THE ASSESSMENT OF SOIL WATER STATUS AS IT AFFECTS PLANT WATER USE,
National Vegetable Research Station, Wellesbourne (England).
E. J. Winter.
Measurement of Environmental Factors in Terrestrial Ecology, Blackwell Scientific Publications, p 147-159, 1968. 33 ref.

Descriptors: *Soil-water-plant relationships, *Lysimeters, *Soil moisture, *Field capacity, *Moisture availability, Wilting point, Excess water (Soils), Microenvironment, Soil water movement, Water utilization, Tensiometers, Earth-water interfaces, Evaporation, Root systems.
Identifiers: *Exploitable water, *Matric suction, *Moisture release curve, Neutron probe, Resistance blocks.

Total soil moisture content and factors which influence water uptake by roots determine the soil water effects on plant communities. The total soil water is easily determined but measuring the amount available to plants is difficult. The available water is defined as the field capacity minus the permanent wilting percentage. As soil water decreases through evaporation and transpiration, matric suction increases and may be measured by a tensiometer. Exploitable water is available water that can be taken up by plants under specific conditions. The efficiency of its removal depends upon root characteristics and rate of soil water movement toward the roots. The moisture release curve of a given soil must be known so that the amount of soil available water after a given application may be determined. The available water capacity of a soil is a function of the soil texture. Soil water removal by plants may be measured directly by lysimeters or by indirect methods. Various in-situ instruments may be used to measure the evaporative potential of soil sites. An appendix outlines the various methods and instruments for assessing the effect of soil water status on plants. (Casey-Arizona)
W70-07799

HYDROLOGICAL IMPLICATIONS OF GRASS ROOTS STUDIES AT A SITE IN EAST AFRICA,
East African Agriculture and Forestry Research Organization, Nairobi (Kenya). Physics Div.
M. Dagg.
Journal of Hydrology, Vol 9, No 4, p 438-444, December 1969. 7 p, 1 fig, 1 tab, 6 ref.

Descriptors: *Soil moisture, *Grasses, *Transpiration, *Moisture deficit, Moisture stress, Water loss, Wilting point, Specific retention, Moisture content, Soil water movement, Soil-water-plant relationships, Climatology, Consumptive use, Dehydration.
Identifiers: *Kenya, Soil moisture resistance.

Soil moisture resistance unit studies show that several perennial grasses root rapidly to depths of 6.1 m under the environmental conditions at Muguga, Kenya, alt. 2070 m, and maintain near potential rates of transpiration until the whole soil profile is near wilting point. With an average annual potential transpiration from grass of 1275 mm, appreciably in excess of the average annual rainfall of 1013 mm, it is concluded that large soil moisture deficits are likely at the start of each rainy season and that through drainage to the groundwater table requires an uncommonly high concentration of about 660 mm of rain within two months. Meteorological and soil conditions over large parts of East Africa would suggest that equally informative results could be obtained elsewhere from simple resistance units, and it has been recommended that routine observation of a few profiles of resistance units over the root range of typical perennial vegetation be added to the normal schedule at agrometeorological stations in East Africa. (Knapp-USGS)
W70-07903

AQUATIC PLANT SURVEY OF MAJOR LAKES IN THE MILWAUKEE RIVER WATERSHED,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 02H.
W70-08104

2J. Erosion and Sedimentation

DEVELOPMENT OF THE ASTORIA CANYON-FAN PHYSIOGRAPHY AND COMPARISON WITH SIMILAR SYSTEMS,
Geological Survey, Menlo Park, Calif. Office of Marine Geology and Hydrology; and Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 02L.
W70-07652

SUBMARINE VALLEY SYSTEMS AROUND THE CORAL SEA BASIN (AUSTRALIA),
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02L.
W70-07653

TRANSPORT AND DEPOSITION OF HOLOCENE SEDIMENT ON LA JOLLA DEEP SEA FAN, CALIFORNIA,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02L.
W70-07654

DISTRIBUTION OF TRACTIVE FORCE IN OPEN CHANNELS,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 08B.
W70-07658

THE ENVIRONMENTAL SIGNIFICANCE OF IRON-STAINED QUARTZ GRAINS ON THE SOUTHEASTERN UNITED STATES ATLANTIC SHELF,
Duke Univ., Durham, N.C. Dept. of Geology; and Duke Univ., Beaufort, N.C. Marine Lab.
For primary bibliographic entry see Field 02L.
W70-07665

COASTAL CURRENTS AND MASS TRANSPORT OF SURFACE SEDIMENTS OVER THE

SHELF REGIONS OF MONTEREY BAY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Office of Marine Geology and Hydrology.
For primary bibliographic entry see Field 02L.
W70-07666

TESTING SEDIMENT MOVEMENT DUE TO WAVE ACTION,
Western Australia Univ., Nedlands. Dept. of Civil Engineering.
Geoffrey R. Mogridge.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7433, p 1587-1604, July 1970. 18 p, 9 fig, 2 tab, 21 ref, append.

Descriptors: *Sediment transport, *Bottom sediments, *Waves (Water), *Hydraulic models, *Wave pile-up, Ocean waves, Critical flow, Sediment load, Bed load, Mass transfer, Supercritical flow, Beaches, Beach erosion, Currents (Water).
Identifiers: Wave tanks.

The development of laboratory equipment to simulate the water particle motion at the sea bed due to wave action is described. Essentially it oscillates a block of water horizontally in a flume. An inverted U-frame constraining the water measures 84 in. long by 48 in. wide by 24 in. high and is large enough to reproduce prototype boundary conditions. A piston drive is supplied by high pressure oil and motion is controlled to follow a sinusoidal input movement. Previous attempts to model wave action for the study of sediment movement are analyzed and the benefits of the present design are outlined. It is proposed that the equipment be used to study the effects of superimposed wave trains and mass transport velocity on sediment movement. (Knapp-USGS)
W70-07668

NONEQUILIBRIUM TRANSPORT OF SUSPENDED SEDIMENT,
Missouri Univ., Columbia. Dept. of Civil Engineering.
Allen T. Hjelmfelt, and Charles W. Lenau.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7430, p 1567-1586, July 1970. 20 p, 6 fig, 11 ref, 9 append. OWRR Project A-017-MO.

Descriptors: *Sediment transport, *Open channel flow, *Alluvial channels, *Scour, *Transition flow, Convection, Diffusion, Suspended load, Stream erosion, Mathematical studies.
Identifiers: Nonequilibrium sediment transport.

The nonequilibrium transport of suspended sediment in an open channel is studied at an abrupt change from a nonerodible to an erodible bed. The convective-diffusion equation is solved for the case of constant velocity distribution and parabolic eddy diffusion coefficient. Diffusion in the direction of flow is neglected. Graphs of the concentration, distribution, the channel-depth average concentration and the scour rate are presented. (Knapp-USGS)
W70-07669

SUSPENDED MATTER IN THE RED SEA BRINES AND ITS DETECTION BY LIGHT SCATTERING,
Lamont Geological Observatory; Palisades, N.Y.; and Woods Hole Oceanographic Inst., Mass.
For primary bibliographic entry see Field 02K.
W70-07687

TEMPERATURE MEASUREMENTS IN THE BOTTOM LAYERS OF THE RED SEA BRINES,
Cambridge Univ. (England). Dept. of Geodesy and Geophysics.
For primary bibliographic entry see Field 02K.
W70-07688

RADIOCARBON CHRONOLOGY OF RED SEA SEDIMENTS,
Woods Hole Oceanographic Institution, Mass.; and Lamont Geological Observatory, Palisades, N.Y.
David L. Thurber, and Guy G. Mathieu.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 348-359, 1969, 12 p, 5 fig, 2 tab, 28 ref. NSF Grants GA-584 and GA-1346.

Descriptors: *Bottom sediments, *Sea water, *Brines, *Paleoclimatology, *Radioactive dating, *Water chemistry, Geothermal studies, Hot springs, Mineralogy, Paleohydrology, Stable isotopes, Sounding, Sampling, Carbon radioisotopes, Chemical precipitation, Geology.
Identifiers: *Red Sea, Hot brines, Paleontology.

Radiocarbon dates have been obtained on seven cores taken from the central part of the Red Sea in the axial trough. The observed sedimentation rates (over the past 20,000 years) range from about 5cm/1,000 yr to more than 60cm/1,000 yr. Variations are primarily due to the episodic precipitation of minerals associated with the geothermal activity of the hot-brine deeps. The brine-derived materials precipitate at a rate of more than 40cm/1,000 yr, whereas accumulation rates of the detrital silicates and calcareous shells are on the order of 2cm/1,000 yr and 8cm/1,000 yr respectively, for the area studied. The abrupt world climatic changes at 11,000 years ago which mark the close of the Wisconsin glacial period seen in these cores. Before the warming of world-wide climate at about 11,000 years B. P., the Red Sea environmental condition must have been one of high salinity and regression of the sea. The sill located near the Strait of Bab el Mandeb must have been effective in limiting the water exchanges between the Red Sea and the Indian Ocean during the low sea stand of the Wisconsin. Intrusions of hot brine into the Atlantis II Deep may have occurred over the last 10,000 years. (See also W70-07394) (Knapp-USGS)
W70-07694

SHIPBOARD COLLECTION AND PRESERVATION OF SEDIMENT SAMPLES COLLECTED DURING CHAIN 61 FROM THE RED SEA,
Woods Hole Oceanographic Institution, Mass.
David A. Ross, and Egan T. Degens.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 363-367, 1969. 5 p, 2 fig, 2 plate, 2 tab, 2 ref.

Descriptors: *Sampling, *Bottom sediments, *Oceans, Oceanography, Cores, Mineralogy, Data collections.
Identifiers: *Red Sea, Hot brines.

A brief description is given of the different coring techniques used during the CHAIN 61 cruise to the Red Sea. Locations, core length, type of sampler used and water depth are given for the Red Sea stations. (See also W70-07394) (Knapp-USGS)
W70-07695

CHEMICAL COMPOSITION OF SEDIMENTS AND INTERSTITIAL BRINES FROM THE ATLANTIS II, DISCOVERY AND CHAIN DEEPS,
Kennecott Copper Corp., Salt Lake City, Utah. Exploration Services; and Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 02K.
W70-07698

MICROSCOPIC AND ELECTRON BEAM MICROPROBE STUDY OF SULFIDE MINERALS IN RED SEA MUD SAMPLES,
Kennecott Copper Corp., Salt Lake City, Utah.
J. D. Stephens, and R. W. Wittkopp.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 441-447, 1969. 7 p, 6 fig, 1 tab, 5 ref.

Descriptors: *Bottom sediments, *Mineralogy, *Sulfides, *Mud, Copper, Iron, Electron microscopy, Hot springs, Analytical techniques, Sampling, Sea water, Water chemistry, Chemical analysis, Brines.
Identifiers: Red Sea, Hot brines, Electron beam microprobe.

Base metal distribution in ten Red Sea mud samples recovered by Woods Hole Oceanographic Institution personnel was studied by microscopic and electron beam microprobe techniques. Most of the base metals in the samples were present as sulfides. The most common sulfide mineral was marcasite, but chalcopyrite and marmatite were also identified in many of the samples. Marcasite occurred as euhedral plate or lath-shaped crystals, frequently perched along the center line of euhedral anhydrite crystals. Chalcopyrite and marmatite occurred as irregular or subhedral particles. In several cases, marmatite rims completely surrounded chalcopyrite particles of chalcopyrite rims surrounded marmatite particles. Mascasite was observed filling the interiors of microfossils in several instances. Static electron beam analysis of the marmatite showed that it contained large amounts of iron. Some of the marmatite also contained substantial amounts of copper and traces of cadmium. Copper and zinc values also occurred as a submicron dispersion in the mud matrix. (See also W70-07394) (Knapp-USGS)
W70-07699

MINERALOGY AND MICROPALEONTOLOGY OF A GOETHITE-BEARING RED SEA CORE,
Washington State Univ., Pullman. Dept. of Geology.
Yvonne Hermann, and P. E. Rosenberg.
Work supported by grants from Office of Naval Research and National Science Foundation. Report available for inspection in USGS-WRD Library, Wash, D C. In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 448-459, 1969. 12 p, 4 fig, 4 tab, 16 ref. ONR Grant Nonr 266 (48).

Descriptors: *Bottom sediments, *Hot springs, *Mineralogy, *Iron compounds, *Spectroscopy, Mud, Analytical techniques, Radioactive dating, Carbon radioisotopes, Sampling, Cores, Sea water, Water chemistry, Chemical analysis, Brines.
Identifiers: Hot brines, Red Sea, Spectrochemical analysis.

The mineralogy and micropaleontology of a goethite-bearing core from the northern Red Sea have been studied. Variations in planktonic microfaunal composition with depth in the core reveal three major climatic phases: Phase I, Postglacial, encompassing the last 11-12,000 years; Phase II, Llate glacial stades which began about 60-65,000 years ago; and Phase III, an interstadial, with a fauna similar to that of Phase I, commencing about 1000,000 years ago. The core is composed of sediments containing scattered, lithified, calcareous fragments and lumps, 3 mm to 2 cm in diameter. Goethite is present in sediment samples at all depths and forms an almost monomineralic bed, deposited near the beginning of Phase III. Spectrochemical analyses of the goethite bed indicate a concentration of several heavy metals in excess of the average reported for marine sediments. The goethite is attributed to hot brine activity. Cross-correlations with C-14 dated Red Sea cores and extrapolations assuming constant rates of sedimentation, suggest that the history of hot brine deposition in the northern Red Sea extends back at least 100,000 years B. P. (See also W70-07394) (Knapp-USGS)
W70-07700

MAGNETIC PROPERTIES OF MINERALS FROM THE RED SEA THERMAL BRINES,
Massachusetts Inst. of Tech., Cambridge; and Woods Hole Oceanographic Institution, Mass.
D. W. Strangway, B. E. McMahon, and J. L. Bischoff.

In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 460-473, 1969. 14 p, 12 fig, 2 tab, 29 ref. NSF Project G. P. 5341.

Descriptors: *Bottom sediments, *Mineralogy, *Hot springs, *Magnetic studies, *Iron compounds, Iron oxides, Geochemistry, Geophysics, Sulfides, Analytical techniques, Sampling, Sea water, Water chemistry, Chemical analysis, Brines.
Identifiers: Red Sea, Hot brines, Magnetic minerals.

Studies of the magnetic properties of sediment samples recovered from the thermal brine area of the Red Sea were made. The minerals which have distinctive magnetic signatures, particularly on heating, are goethite, lepidocrocite, siderite, manganosiderite, pyrite, hematite and small quantities of a ferrimagnetic mineral, which is probably maghemite. Hematite is present in two of the cores recovered from the Atlantis II Deep. The magnetic properties indicate that this material is coarse-grained. By contrast the hematite formed chemically during heating experiments is fine-grained. A ferrimagnetic mineral, probably maghemite, is present in many of the samples examined. Most of this material is destroyed by heating above 500 deg C. The absence of an observable Neel temperature effect in the goethites at 120 deg C is attributed to the small grain sizes, making much of the material superparamagnetic at room temperature. Other data indicate that much of the goethite is in particles less than 100 angstroms. (See also W70-07394) (Knapp-USGS
W70-07701

SULFUR ISOTOPE STUDIES ON RED SEA GEOTHERMAL BRINES AND SEDIMENTS,
California Univ., Los Angeles. Dept. of Geology; and California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
I. R. Kaplan, R. E. Sweeney, and Arie Nissenbaum.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 474-498, 1969. 25 p, 7 fig, 12 tab, 52 ref. ACS-PRF Number 2815-A2.

Descriptors: *Bottom sediments, *Sea water, *Hot springs, *Stable isotopes, *Sulfur, Analytical techniques, Sampling, Tracers, Water chemistry, Evaporation, Brines.
Identifiers: *Red Sea, Hot brines, Sulfur isotopes, Isotope analysis.

Sulfur isotope ratio meansurements and trace element analyses were performed on sediment from selected cores from the Red Sea geothermal deposit, the overlying brine and interstitial water. The data show that delta S-34 falls into four general ranges: (1) over 25 per mill, (2) +23 to +15 per mill, (3) +12 to +2 per mill, (4) less than -25 per mill. Sulfate in the brine appears to have been derived from marine evaporites, whereas sulfide originates from two sources. In the Atlantis II Deep, it is derived from a hydrothermal process and introduced with the brine. In the other areas, biological sulfate reduction produces sulfide which precipitates metals from the brine originating in the Atlantis II Deep. (See also W70-07394) (Knapp-USGS)
W70-07702

LEAD ISOTOPES MEASUREMENTS ON SEDIMENTS FROM ATLANTIS II AND DISCOVERY DEEP AREAS,
Australian National Univ., Canberra.
J. A. Cooper, and J. R. Richards.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Spring-Verlag New York Inc, p 499-511, 1969. 13 p, 5 fig, 2 tab, 37 ref.

Descriptors: *Bottom sediments, *Lead radioisotopes, *Stable isotopes, Mineralogy, *Hot springs, Brines, Analytical techniques, Sampling, Sea water, Water chemistry, Chemical analysis, Trace elements.
Identifiers: *Red Sea, Hot brines, Lead isotopes.

In a study of the recent mineralized sediments from the Central Red Sea, a clear difference in the lead isotope pattern is observed in core sections of up to 5m in depth betweeen those from Atlantis II Deep on the one hand and the Discovery Deep and barren sediments on the other. In general, low heavy-metal concentrations correlate with a low overall content of lead with variable isotopic ratios, a pattern observed in other areas of marine sedimentation. The more mineralized samples of Atlantis II Deep, with greater quantities (up to 500ppm) of lead, point to an ore source material with only small isotopic variation. The Discovery Deep samples, although mineralized, exhibit isotopic variation in the lead, suggesting significant contamination, in conformity with ideas that this 'pool' is an overflow from the Atlantis II Deep. Possible sources of the mineralization are considered. It is suggested that the mode of mineralization represented by this deposit is one very possible mechanism for the formation of 'Pyritic Conformable' or 'Straitiform' ore bodies. (See also W70-07394) (Knapp-USGS)
W70-07703

URANIUM SERIES ISOTPES IN SEDIMENTS FROM THE RED SEA HOT-BRINE AREA,
Woods Hole Oceanographic Institution, Mass.
Teh-Lun Ku.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Spring-Verlag New York Inc, p 512-524, 1969. 13 p, 4 fig, 6 tab, 23 ref. NSF Grant GA-584.

Descriptors: *Uranium radioisotopes, *Bottom sediments, *Brines, *Hot springs, *Radioactive dating, Sea water, Radiochemical analysis, Water chemistry, Chemical analysis, Trace elements, Analytical techniques.
Identifiers: *Red Sea, Hot brines, Thorium isotopes.

The distribution of the longer-lived uranium and thorium series isotopes in the iron-rich sediments of the Red Sea geothermal brine area is characteristics. Concentrations of uranium on a salt- and water-free basis range from 6 to 30 ppm, wheras those of thorium range from 0.1 to 0.5 ppm. The low Th/U ratios are also reflected by the low activity ratios of Th-230/U-234 and Pa-231/U-235, considerably less than the secular equilibrium value of unity. Maximum ages of the deposits may be estimated. The metalliferous sediments accumulated at a rate of at least 40 cm/1000 yr and that the sampled four to eight meters of sediment columns in the Atlantis II Deep were deposited in less than 10,000 years. An important fraction of uranium may have been scavenged out of the overlying normal Red Sea water through co-precipitation with the colloidal ferric hydroxide and silica. (See also W70-07394) (Knapp-USGS)
W70-07704

COMPARISON BETWEEN RED SEA DEPOSITS AND OLDER IRONSTONE AND IRON-FORMATION,
Geological Survey, Washington, D.C.
Harold L. James.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Spring-Verlag New York Inc, p 525-532, 1969. 8 p, 1 fig, 2 tab, 21 ref.

Descriptors: *Bottom sediments, *Mineralogy, *Geochemistry, *Hot springs, *Brines, Water chemistry, Iron compounds, Trace elements, Sea water, Carbonate rocks, Geology, Sediments, Diagenesis, Leaching.
Identifiers: *Red Sea, Hot brines, Ironstone, Iron formations.

Physically the Red Sea sediment is utterly unlike either ironstone or iron-formation, but chemically it has affinities to both except for its remarkable content of base and precious metals. If the Red Sea sediment were being deposited in an environment of strong current and wave action, the resulting product probably would be an ironstone of reasonably orthodox character. If it were to be buried in its present form, a remote possibility exists that it could become chemically differentiated through dewatering and diagenetic processes to yield an end product comparable to iron-formation, but more likely a substantial part of the iron and much or all of the base metals would migrate in hot brine solutions to be reprecipitated in laterally continuous carbonate host rocks. (See also W70-07394) (Knapp-USGS)
W70-07705

ECONOMIC POTENTIAL OF THE RED SEA HEAVY METAL DEPOSITS,
Woods Hole Oceanographic Institution, Mass.; and Geological Survey, Woods Hole, Mass.
J. L. Bischoff, and F. T. Manheim.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Spring-Verlag New York Inc, p 535-541, 1969. 7 p, 2 fig, 3 tab, 12 ref. NSF Grant GA-584.

Descriptors: *Bottom sediments, *Mining, *Economics, *Mineralogy, Hot springs, Brines, Geochemistry, Water chemistry, Costs, Iron compounds, Trace elements, Sea water, Geology, Sediments.
Identifiers: Mining costs, Red Sea, Hot brines.

Average assays of metals in Atlantis II Deep deposits are: Fe, 29 per cent; Zn, 3.4 per cent; Cu, 1.3 per cent; Pb, 0.1 per cent; Ag, 54 ppm; Au, (probably) 0.5 ppm. The deposits contained from 55 to 96 per cent interstitial brine, averaging about 85 per cent. Total brine-free sediment in the upper 10 m of sediment is estimated to be over 50 million tons. At current smelter prices for Zn, Cu, Pb, Ag and Au these metals would be worth about 2.5 billion dollars. Deposits in the adjacent Discovery Deep contain lower, but still abnormal, metal concentrations. Metal-bearing deposits probably extend to a depth of about 20 m below the sediment surface, but the metal grade of sediments below 10 m is unknown. Size and grade of the deposits appear to make the deposits attractive for explitation. (See also W70-07394) (Knapp-USGS)
W70-07706

INTERFERENCE RIPPLE MARKS FORMED BY EPHEMERAL STREAMS,
Utah Univ., Salt Lake City. Dept of Geological and Geophysical Sciences; and Oberlin Coll., Ohio. Dept. of Geology.
M. Dane Picard, and Lee R. High, Jr.
Journal of Sedimentary Petrology, Vol 40, No 2, p 708-711, June 1970. 4 p, 4 fig, 1 tab, 13 ref. NSF Grant (GA-12570).

Descriptors: *Ripple marks, *Sedimentary structures, *Ephemeral streams, *Alluvial channels, Sand waves, Dunes, Regime, Currents (Water), Turbulence, Turbulent flow, Waves (Water).
Identifiers: Interference ripple marks.

Interference ripple marks form during floods along many ephemeral streams. Cuspate (linguoid) ripples form first when flood water in the channel is deep enough to flow over marginal and channel sand bars. As the water level falls, downstream currents are refracted shoreward over the marginal sand bars and linear ripple sets are formed on the tops and flanks of the bars. The linear ripples are oriented at right angles to the cuspate ripples and commonly form interference sets with them. Refracted waves and changing water level over the irregular bottom can complicate further the patterns of asymmetric ripple marks and other directional structures. Paleocurrent patterns of fluvial deposits are probably more complex than has been generally recognized. The distribution of directional structures in modern streams is, in general, unimodal and the dominant inclinations of foreset laminae are downstream. (Knapp-USGS)
W70-07892

ANNUAL SUSPENDED SEDIMENT SUPPLIED TO THE CALIFORNIA CONTINENTAL BOR-

DERLAND BY THE SOUTHERN CALIFORNIA WATERSHED,
Illinois Univ., Chicago.
Kelvin S. Rodolfo.
Journal of Sedimentary Petrology, Vol 40, No 2, p 666-671, June 1970. 6 p, 3 fig, 12 ref.

Descriptors: *Suspended load, *Sediment load, *Rivers, *California, Sediment yield, Sediment transport, Particle size, Mineralogy, Sampling, Analytical techniques.
Identifiers: Southern California.

Southern California streams were sampled at their mouths during a rainy season to determine the concentrations, grain sizes, mineralogy and quantities of suspended sediment supplied to the ocean by the southern California watershed. Approximately 3.5 million tons of suspended sediment are brought to the ocean annually by southern California streams. About 0.8 million tons are arkosic sands, and the remaining 2.7 million tons of river-supplied sediment are silts, clays, colloids and dissolved material. Approximately 4.2 million tons of sand can be attributed to stream traction load. Southern California supplies 7.7 million tons of terrigenous material to the Continental Borderland every year. This estimate agrees well with rates of supply which have been calculated from seismic profiling surveys. (Knapp-USGS)
W70-07893

THE INFLUENCE OF AREAL TRENDS ON CORRELATIONS BETWEEN SEDIMENTARY PROPERTIES,
Northwestern Univ., Evanston. Ill.; and Esso Production Research Co., Houston, Tex.
W. C. Krumbein, and Thomas A. Jones.
Journal of Sedimentary Petrology, Vol 40, No 2, p 656-665, June 1970. 10 p, 6 fig, 6 tab, 5 ref.

Descriptors: *Statistical methods, *Correlation analysis, *Sedimentology, Sedimentary structures, Statistics, Mineralogy, Particle size, Provenance, Simulation analysis, Statistical models.
Identifiers: Trend surface analysis.

The search for relations among sedimentary properties is a basic procedure in the interpretation and reconstruction of sedimentary environments. These relations are commonly expressed as the correlation coefficient, r, between pairs of variates plotted on scatter diagrams. The observed correlations are closely related to trends or systematic patterns of areal variation in the data. The coefficients of trend surfaces can be used to predict the correlation between two mapped variables, and by expressing the correlation in terms of its covariance and variances, the observed relations can be partitioned into systematic and residual portions. A shift of emphasis for consideration of correlation coefficients (which are not additive) to covariance sums of crossproducts (which are) affords additional opportunities for analyzing the contributions of two or more sources of covariation. In this approach trend surface analysis plays an important role in partitioning the crossproduct sum. A statistical model is presented for this purpose, and some sources of covariation in beach foreshore properties are examined in part by simulation studies of areal patterns of variation and the population densities of mapped variables. (Knapp-USGS
W70-07894

MINERALOGY AND DISTRIBUTION OF CLAY SIZE SEDIMENT IN GLACIER BAY, ALASKA,
State Univ. Coll., Potsdam. Dept. of Geology; and Alaska Univ., College. Inst. of Marine Science.
Neal R. O'Brien, and D. C. Burrell.
Journal of Sedimentary Petrology, Vol 40, No 2, p 650-655, June 1970. 6 p, 4 fig, 10 ref. AEC Contract AT- (04-3)-310.

Descriptors: *Clays, *Mineralogy, *Sediments, *Fjords, *Alaska, Glaciers, Glacial drift, Bottom sediments, X-ray analysis, X-ray diffraction, Weathering, Provenance.
Identifiers: Glacier Bay (Alaska).

The mineralogy of clay size bottom sediment was studied in the main channel and adjacent fjords in Glacier Bay, Alaska to determine if a lateral change in clay composition occurs as sediment is carried from a fresh water to marine environment. X-ray analysis indicates a dominance of chlorite and trioctahedral mica which does not change in composition or abundance laterally. The lack of diagenetic formation of new minerals probably is due to the rapid rate of clay sedimentation and also due to the minor amount of chemical degradation at the source in this subarctic environment. (Knapp-USGS)
W70-07895

GRAIN SIZE PARAMETERS FOR SANDY-GRAVELS,
Southampton Univ., (England). Dept. of Oceanography.
K. R. Dyer.
Journal of Sedimentary Petrology, Vol 40, No 2, p 616-620, June 1970. 5 p, 5 fig, 1 tab, 12 ref.

Descriptors: *Classification, *Particle size, *Gravels, *Sands, Statistical methods, Sediments, Sampling.
Identifiers: Sandy gravels.

A series of parameters are proposed to describe the grain size frequency distribution of sandy-gravels. They are shown to be selective in distingusihing variations in the proportions of the two modes, especially at 25% sand, an important point in the packing of bimodal materials. A number of samples from the Solent, a channel between Hampshire, England, and the Isle of Wight, are considered as examples of the sedimentary significance of the use of the parameters in a tidal enviornment. (Knapp-USGS)
W70-07896

EROSION BY BIOLOGICAL ACTIVITY IN TWO NEW ENGLAND SUBMARINE CANYONS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
William P. Dillon, and Herman B. Zimmerman.
Journal of Sedimentary Petrology, Vol 40, No 2, p 542-547, June 1970. 6 p, 9 fig, 9 ref.

Descriptors: *Canyons, *Underwater, *Erosion, Sediment transport, Biochemistry, Weathering, Sediments, Topography.
Identifiers: Biological erosion processes, Submarine canyons.

Observations from Deepstar 4000 in Block and Corsair Canyons indicate that, at present, erosion is predominantly biological. No evidence for large mass movements in the axis area or recent turbidity current activity was observed in either canyon. (Knapp-USGS)
W70-07897

VELOCITIES OF CULVERT JETS FOR INCIPIENT EROSION,
Geological Survey, Mineola, N.Y.; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Gerald E. Seaburn, and Louis M. Laushey.
French summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C1, p 1-8, 1967. 8 p, 4 fig.

Descriptors: *Scour, *Culverts, *Jets, *Engineering structures, *Erosion, Streambeds, Stilling basins, Stones, Pipe flow, Momentum equation, Shear drag, Tailwater.
Identifiers: *Velocities of culvert jets, Streambed erosion.

High capacity culverts too often cause streambed erosion at the outlet. The construction of stilling basins designed to reduce erosion is too expensive and is seldom justified for small culverts. Theoretical and experimental studies were undertaken using loose stones to prevent erosion at the outlet of small culverts. The critical velocity that will initiate erosion was found by trials under full-pipe and partially-full pipe flows. In the full-pipe flow, the critical momentum was proportional to the cube of the stone size. Further, a larger velocity was required to scour the spheres than the stones, because the spheres have a smaller drag coefficient and a better hydrodynamic shape. The pipe diameter is not a useful parameter in partially-full pipe flow. The critical velocity of the outlet of culverts required to initiate the scouring of a noncohesive bed is (1) dependent on the size of stones and the diameter of the culvert if the culvert flows full; and (2) dependent on the stone size but independent of the diameter of the culvert if this flows only partly full. The tailwater provided no protection against bed erosion when the depth of pipe was less than one-half of the pipe diameter. (Carstea-USGS)
W70-07912

INITIAL SCOUR AND SEDIMENT MOTION DUE TO AN IMPINGING SUBMERGED JET,
Technion - Israel Inst. of Tech., Haifa.
For primary bibliographic entry see Field 08B.
W70-07913

DETERMINATION OF THE DEPTH OF SCOUR AROUND AN OBSTRUCTION IN AN ALLUVIAL CHANNEL,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 08B.
W70-07914

MEAN-VELOCITY CRITERION FOR SCOUR OF COARSE UNIFORM BED-MATERIAL,
Research Council of Alberta, Edmonton.
C. R. Neill.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C6, p 46-54, 1967. 9 p, 4 fig, 1 tab, 11 ref.

Descriptors: *Scour, *Streambeds, *Sediment transport, *Bed load, Flumes, Particle size, Flow, Shear stress, Channels, Erosion, Alluvial channels.
Identifiers: Stones.

Flume experiments were conducted using 6 to 30 mm grain-size particles for uniform bed materials to study the initial motion of particles. A nomogram was derived which gives the 'competent mean velocity' for coarse materials in terms of grain size, grain density, and depth of flow. The conditions under which single stones in a uniform bed will be first displaced under gradually increasing strength of flow are given. The first displacement of particles are correlated with mean velocity rather than shear stress. The mean-velocity data for uniform coarse material in wide channels compared well with data of other investigators who used materials up to 140 mm. A direct comparison with Shield's data is not possible. (Carstea-USGS)
W70-07915

ON THE MECHANISM OF THE LOCAL SCOUR FROM FLOWS DOWNSTREAM OF AN OUTLET,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Yoshito Tsuchiya, and Yuichi Iwagaki.
Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C7, p 55-64, 1967. 10 p, 8 fig, 6 ref.

Descriptors: *Scour, *Outlets, *Hydraulic structures, *Sediment transport, Downstream, Jets, Tractive forces, Particle size, Mathematical models, Saltation, Specific gravity, Shear, Velocity, Model studies, Alluvial channels, Stream erosion.

Identifiers: *Scour development, Scour mechanisms.

Local scour downstream of hydraulic structures is a very complicated phenomenon because the sediment is transported under nonequilibrium conditions. Basic experiments were conducted on the local scour downstream of an outlet using theories of wall jets and of critical tractive force. Both the initial and progressive stages of development of local scour were studied. A simple mathematical model describes nonequilibrium transport. Saltation length, shear velocity, sedimentation rates, critical shear velocity, distance, specific gravity of grains, and grain size need to be known in order to calculate the rate of sediment transport. In the initial stage of development, the theoretical configuration of the scour hole, rate of sediment transport, and change in maximum depth of scour are in good agreement with the experimental values. In the progressive stage of scour development, the maximum rate of sediment transport occurs at the end of the scour hole. The scour process becomes stable when the sediment in the scour hole cannot move along the hole because of the decrease in the shear velocity, and the rate of sediment transport by the wall jet becomes equivalent to the recurrent rate due to the roller. (Carstea-USGS)
W70-07916

SCOUR IN STONE BEDS,
Saskatchewan Univ., Saskatoon. Dept. of Civil Engineering; and Crippen (G. E.) and Associate Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 08B.
W70-07917

NOTE ON THE METHODS OF STUDY OF THE LOCAL SCOUR OF BED ROCKS ON A REDUCED MODEL,
P. Wisner, M. Radu, and G. Armencea.
English summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C9, p 74-82, 1967. 9 p, 8 fig, 10 ref.

Descriptors: *Scour, *Alluvial channels, *Streambeds, *Model studies, *Energy dissipation, Dams, Spillways, Velocity, Arch dams, Cohesive soils, Cohesionless soils, Sands, Sediment transport, Stream erosion.
Identifiers: *Scour below dams.

Experiments were conducted to study the intensity of local scour below dams as a function of bed material and water velocity. Two kinds of experiments are of particular interest because of their natural occurrences: (1) A spillway with an energy dissipator, and (2) spillway with an arch-dam that throws a free nappe on an unprotected bed. Using an energy dissipator, the scour depth for a bed of cohesive material was much deeper than for noncohesive material. With no energy dissipator, the form of the scour hole in a bed of concrete blocks was localized and shallower than in a sand bed. (Carstea-USGS)
W70-07918

THE GEOMETRICAL DEVELOPMENT AND DEVELOPMENT IN TIME OF SCOUR BENEATH A THIN SLAB,
Hydraulic Research Inst., Prague (Czechoslovakia).
Zdenek Thomas.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C10, p 83-91, 1967. 9 p, 4 fig, 3 ref.

Descriptors: *Scour, *Hydraulic structures, *Sediment transport, Hydraulic models, Model studies, Flumes, Tunnels, Sands, Streambeds, Streams, Flow around objects, Bed load, Stress, Stream erosion, Sedimentation.
Identifiers: *Scour geometry, Scour development, Wind tunnel studies.

Flume experiments were carried out using an aerodynamic tunnel to study the geometry and development of scour. The scour of the sandy bottom was accomplished by air currents around a metal sheet. The distance of the lower edge of the slab to the streambed was varied and the scour was measured for various angles of the slab in relation to the horizontal line. The maximum depth of scour was dependent upon its maximum length. The rate of scour formation is not dependent on the distance of the lower edge of the slab from the sand surface but it is dependent upon the angle of inclination of the slab. Empirical equations were derived for the main geometrical characteristics of scour process as a funtion of inclination angles. Empirical formulas relate the scour depth to the resistance coefficient of bottom and to the tangential stress which corresponds to the beginning of bed load movement. There is good agreement between theoretical conclusions and practical results. (Carstea-USGS)
W70-07919

CONSIDERATIONS CONCERNING SCOUR IN THE CASE OF FLOW UNDER GATES,
Technische Hochschule, Munich (West Germany).
For primary bibliographic entry see Field 08B.
W70-07920

ON SCOUR AROUND SPUR-DIKE,
Nihon Univ., Tokyo.
Seizo Awazu.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C12, p 97-104, 1967. 8 p, 4 fig, 3 ref.

Descriptors: *Scour, *Dikes, *Sediment transport, Model studies, Hydraulic models, Channels, Streambeds, Shear stress, Sands, Hydraulic structures, Discharge (Water), Streams, Velocity, Flow profiles.
Identifiers: Movable stream bed, Fixed streambed.

To study the scour process, a movable bed was replaced by a fixed bed and the scouring phenomenon was calculated from the shear and normal forces. The first set of experiments was designed to study the beginning of scouring process. The velocity profiles were determined at every cross-section of the channel centerline, and the shear stress was evaluated. Flow patterns around spur-dikes on movable beds are similar to those on fixed bed channels. There is a direct relationship between the maximum shear stress at the channel centerline and the shear stress where the scouring is expected to occur. The seepage force upon sand grains around spur-dikes is negligible for the distance the spur-dike extends into the impermeable layer. A second set of experiments was intended to study the maximum scour depth using two experimental designs: (1) Two spur-dikes were placed symmetrically, one on each side of a movable bed channel, and (2) A spur-dike was placed on one side of the channel. The data were helpful in proposing formulas on the scour around the spur-dikes. (Carstea-USGS)
W70-07921

SCOUR BELOW SUBMERGED SOLID BUCKET-TYPE ENERGY DISSIPATORS,
Mysore Engineering Research Station, Krishnarajasagara (India).
For primary bibliographic entry see Field 08B.
W70-07922

SCOURS BEHIND STILLING BASINS WITH ENDSILLS OF BAFFLE-PIERS,
Technische Hochschule, Brunswick (West Germany).
For primary bibliographic entry see Field 08B.
W70-07923

AN INTERESTING HYDRAULIC EFFECT OCCURRING AT LOCAL SCOUR,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 08B.
W70-07924

EROSION EXPERIENCE DOWNSTREAM OF BED STABILIZATION AND WATER LEVEL CONTROL STRUCTURES,
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 08B.
W70-07925

EVOLUTION OF SCOUR DOWNSTREAM FROM A MOBILE BARRAGE RESTING ON INCOHERENT MATERIAL, AND SOME CONSIDERATIONS OF THE SCOUR MECHANISM,
State Hydraulic Works, Ankara (Turkey). Dept. of Research.
For primary bibliographic entry see Field 08B.
W70-07926

ANALYTICAL STUDIES ON THE EFFECT OF FRICTION AND COHESION ON FLOTATION GRADIENTS,
Punjab Univ., Chandigarh (India).
For primary bibliographic entry see Field 08B.
W70-07927

MECHANISM AND COMPUTATION OF LOCAL AND GENERAL SCOUR IN NONCOHESIVE, COHESIVE SOILS AND ROCK BEDS,
Ts. E. Mirtskhulava, I. V. Dolidze, and A. V. Magomedova.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C20, p 169-176, 1967. 8 p, 1 tab, 9 ref.

Descriptors: *Scour, *Cohesive soils, *Cohesionless soils, *Streambeds, Erosion control, Flow, Turbulent flow, Forecasting, Mathematical studies, Design criteria, Sediments, Sediment transport.
Identifiers: *Local scour, *General scour, Scour depth.

Based on the structure design principles and on the spreading stream theory a relation is given for prognosis of the deepest local scour of noncohesive, cohesive and rock beds. Theoretical, laboratory, and field investigations were used to provide a solution for general and local scour problems. The analogy between the destruction of cohesive soils due to 'fatigue' and that due to trubulent flow was also considered. The problems studied were: (1) The intensity of scour in relation to flow and soil properties; (2) prediction of time required for a given soil to scour; and (3) prediction of scour stabilization. The theory of probability was used to predict erosion in heterogeneous, noncohesive soils. There was good agreement between the experimental and field data. (Carstea-USGS)
W70-07928

A STUDY ON SEEPAGE SURFACE EROSION IN NONCOHESIVE SOILS,
Chalmers Univ. of Technology, Goteborg (Sweden). Hydraulics Div.
S. Lennart Rahm, and Bo G. Appelgren.
French summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C21, p 177-184, 1967. 8 p, 4 fig, 1 ref.

Descriptors: *Seepage, *Sheet erosion, *Soil erosion, *Cohesionless soils, Particle size, Water level fluctuations, Water levels, Water storage, Groundwater, Slope stability, Watershed management, Model studies, Equations, Hydraulic gradient, Groundwater movement.

Identifiers: *Groundwater erosion.

Repeated level fluctuations in water storages may by means of groundwater erosion cause considerable damage on unprotected slopes in fine frictional soils. The stable slope section is then rather gentle with safe strength against extensive and even local sliding. On that account the stability concept derives from the entrainment of individual grains at the seepage surface. In this connection the potential field close to the lower terminus of the seepage surface is discussed theoretically, and asymptotic solutions satisfying nonlinear boundary condition are presented. As a practical result it follows that a classical linear condition is reasonable, as the range of nonlinearity is small relative to the grain size. The results of tests carried out for various frictional soils and slope inclinations show that the concept of a critical seepage surface extension offers a simply measurable property. This concept was even applicable to slope section development at repeated level fluctuations considered in long-term tests. (Carstea-USGS)
W70-07929

A THEORETICAL AND EXPERIMENTAL STUDY OF DRAG AND LIFT FORCES ACTING ON A SPHERE RESTING ON A HYPOTHETICAL STREAMBED,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
Neil L. Coleman.
French summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C22, p 185-192, 1967. 8 p, 4 fig, 4 ref.

Descriptors: *Sediment transport, *Bed load, *Shear drag, *Particle shape, Tractive forces, Sediments, Flow, Laminar flow, Bottom sediments, Streambeds, Reynolds number, Settling velocity.
Identifiers: Drag forces, Lift forces.

A critical force equation is derived for the case of a sphere resting on a bed composed of similar spheres. The analysis includes quantitative consideration of the effects of both interparticle geometry and the action of a supposed lift force. Experiments based on the analysis are described. The drag coefficient-Reynolds number function for the sphere at rest on a bed is shown to be essentially the same as for a sphere in free fall over a range of Reynolds numbers from about 50 to 9400. A lift factor appearing in the critical force equation is shown to be dependent on the particle Reynolds number, and evidence is presented which indicates that the algebraic sign of this lift factor may depend on the presence or absence of a laminar sublayer in the flow in the vicinity of the sphere. Extension of the analytic and experimental results to the case of inception of motion of real sediment particles is briefly discussed. (Carstea-USGS)
W70-07930

LOCAL SCOUR AROUND A CIRCULAR CYLINDER,
Kobe Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-07931

APPLICATION OF THE WALL JET THEORY TO EROSION AT THE OUTLET OF HYDRAULIC STRUCTURES,
Corps of Engineers, Mariemont, Ohio; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-07932

ON THE FLOW CHARACTERISTICS OF VORTICES IN THREE-DIMENSIONAL LOCAL SCOUR,
Waterloopkundig Laboratorium, Delft (Netherlands).
J. J. Vinje.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C25, p 207-217, 1967. 11 p, 5 fig, 8 ref.

Descriptors: *Flow characteristics, *Vortices, *Scour, *Sediment transport, Streambeds, Cohesionless soils, Hydraulic structures, Model studies, Hydraulic models, Research and development, Prototype tests, Forecasting.
Identifiers: Mobile bed, Fixed bed.

Scour which is caused by vortices in noncohesive bed material is generally more serious than the local scour associated with two-dimensional flow. For practical purposes, the development of the scouring process with time is very important considering the economy and the stability of structures. For a correct prediction of the time history for prototype conditions, experiments were conducted to establish relationships between sediment transport and flow characteristics. Tests were made with an obstacle in steady flow. A model with fixed bottom was used in order to find relationships between the characteristics of flow and the vortices. (Carstea-USGS)
W70-07933

THE EFFECT OF ENTRAINED AIR ON THE SCOURING CAPACITY OF WATER JETS,
Societe Grenobloise d'Etude et d'Applications Hydrauliques (France).
Geoffrey Johnson.
Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C26, p 218-226, 1967. 9 p, 4 fig, 6 ref.

Descriptors: *Scour, *Jets, *Air entrainment, Spillways, Tailwater, Diffusion, Nozzles, Gravels, Hydraulics, Turbulent flow, Open channel flow.
Identifiers: *Scouring capacity, Aerated jets.

The scouring capacity of a jet can be significantly changed by air entrainment in the jet. This is particularly important for spillways with wide flow dispersion and subsequent penetration into deep tailwater. Experiments were conducted to study the effect of tailwater upon the scour depth. At shallow tailwater, the scour depth showed a rapid initial increase followed by a very slow increase, over a long period. As the tailwater depth increases beyond that corresponding to maximum scour, the decrease in scour depth becomes regular and appears to correspond with jet diffusion. The compact and dispersed water jets produced similar scours. The air water jet is much more rapidly diffused and the scour ceases at approximately half the tailwater depth required for the solid jet. The significance of the scour depth limit was made by comparing mathematical expressions with practical results. (Carstea-USGS)
W70-07934

THE SCOURING ENERGY OF THE MACROTURBULENT FLOW DOWNSTREAM OF A HYDRAULIC JUMP,
Technische Hochschule, Munich (West Germany). Hydraulics Research Station, Obenach.
For primary bibliographic entry see Field 08B.
W70-07935

SOME HYDRAULIC CHARACTERISTICS OF TRAPEZOIDAL DROP STRUCTURES,
Alabama Univ., Huntsville. Dept. of Fluid Mechanics; and Federal Power Commission, Washington, D.C.
For primary bibliographic entry see Field 08B.
W70-07936

TIME SCALE OF TWO-DIMENSIONAL LOCAL SCOUR,
Waterloopkundig Laboratorium, Delft (Netherlands).
H. N. C. Breusers.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C32, p 275-282, 1967. 8 p, 6 fig, 3 ref.

Descriptors: *Scour, *Dimensional analysis, *Sediment transport, Sediments, Time, Model studies, Hydraulic models, Velocity, Streams, Streamflow, Streambeds, Turbulence, Flumes.
Identifiers: *Local scour, Noncohesive sediments, Hydraulic conditions.

The time scale of the scouring process in noncohesive sediments should be estimated from considerations of the sediment transport and the flow pattern in the scouring holes. Model studies showed that the maximum scouring depth varied exponentially with time and the relationship was nearly independent of the flow configuration. The determination of time scale for different conditions was carried out in 3 flumes of different size on a scouring stony streambed. The velocity profile and the turbulence intensity are important factors in the scouring process and this importance was documented experimentally. The use of time scale is justified by the similarity of experimental scouring holes under different conditions. (Carstea-USGS)
W70-07937

INFLUENCE OF TIME AND HYDROGRAPH OF FLOODWATER ON THE EROSION OF ARTIFICIALLY CONTRACTED STREAM BEDS,
For primary bibliographic entry see Field 08B.
W70-07938

EFFECT OF FLOOD HYDROGRAPHS ON THE REGIME OF ALLUVIAL AND BOULDER STAGE RIVERS ABOVE AND BELOW CONTROL STRUCTURES,
Uttar Pradesh Irrigation Research Inst., Roorkee (India).
For primary bibliographic entry see Field 08B.
W70-07939

COMPUTATIONS ON NON-STEADY BEDLOAD-TRANSPORT BY A PSEUDO-VISCOSITY METHOD,
Waterloopkundig Laboratorium, Delft (Netherlands).
C. B. Vreugdenhil, and M. de Vries.
French summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C35, p 303-313, 1967. 11 p, 6 fig.

Descriptors: *Bed load, *Sediment transport, *Viscosity, Channel morphology, Alluvial channels, Banks, Numerical analysis, Hydraulic properties, Erosion, Sedimentation, Model studies, Streams.
Identifiers: *Non-steady bed-load transport, Pseudo-viscosity method, Channel geometry.

The behavior of the bottom level of an alluvial channel with fixed banks is studied with regard to changes in hydraulic conditions. The numerical procedure and the concept of pseudo-viscosity used for computations of non-steady bed-load transport are discussed. Examples of computation by the method of characteristics are given for a simple case of erosion or sedimentation and for a mixed case of erosion and sedimentation. These computations are compared with experimental data from a river model in the Netherlands. There is a reasonable agreement between field measurements and computations. (Carstea-USGS)
W70-07940

RIVER BED SCOUR AT BRIDGE CONSTRICTIONS,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 08B.
W70-07941

BANK PROTECTION ON U.S. NAVIGABLE WATERWAYS,
Mississippi River Commission, Vicksburg. Channel Improvement Branch.
Raymond H. Haas, and Jimmie Graham.
Perma. Int. Asso. of Navigation Congr., XXIInd Int. Navigation Congr., Sect. 1, Subj 6, Inland Navigation, p 169-197, Paris, 1969. 29 p, 8 photo, 19 ref.

Descriptors: *Retaining walls, Alluvial channels, Grading, Dredging, Laterals, Detention reservoirs, Costs, Bank stability.
Identifiers: Direct protection, Indirect protection.

Bank revetments must be designed within a framework covering the grading and determination of rivers. The paper deals with both the actual revetment of banks (called direct protection) and the structures intended to determine curves, alignments and depths (called indirect protection). The problem of free current rivers in the alluvian zone is analyzed. The layout of the channel should interfere as little as possible with free current rivers; this standard is the lowest cost alternative. The choice of the type of revetment depends on numerous factors which can react with each other (sediment concentration, mechanical characteristics of the soil, upward pressures). Five methods for the stabilization of rivers are given: grading of the bed, dredging, canalization, lateral canals, and accumulation reservoirs. Grading is the most practical and the cheapest method. The article is written in English and includes a French summary. (Grossman-Rutgers)
W70-07942

BANK PROTECTION OF THE MANCHESTER SHIP CANAL,
Manchester Ship Canal Co. (England).
For primary bibliographic entry see Field 08A.
W70-07943

SHIP-CANAL BANK PROTECTION,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08A.
W70-07944

ECONOMICS OF BANK PROTECTION ON CANALS AND NAVIGABLE RIVERS (IN FRENCH),
Service Technique de la Direction des Ports Maritimes et des Voies Navigables (France).
For primary bibliographic entry see Field 08A.
W70-07947

THE STUDY OF THE SCOURS BEHIND A SPILLWAY, (IN FRENCH),
For primary bibliographic entry see Field 08B.
W70-08095

2K. Chemical Processes

A FOURTH BRINE HOLE IN THE RED SEA,
Atlantic Oceanographic and Meteorological Labs., Miami, Fla. Sea Air Interaction Lab.
Feodor Ostapoff
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 18-21, 1969. 4 p, 3 fig, 2 tab, 8 ref

Descriptors: *Exploration, *Oceanography, *Water chemistry, *Brines, Density stratification, Sounding, Water temperature, Surveys.
Identifiers: *Red Sea, Hot brines.

This paper discusses some of the results of the OCEANOGRAPHER (USC and GSS) crossing of the Red Sea. A possible new hot hole was observed 617km north-northwest of the original hot brine area. Three reflecting layers were observed in the Atlantis II Deep that are apparently related to the different brine layers. (See also W70-07394) (Knapp-USGS)
W70-07679

GEOLOGICAL STRUCTURES OF THE RED SEA AREA INFERRED FROM SATELLITE PICTURES,
North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
For primary bibliographic entry see Field 07B.
W70-07680

THE RED SEA -- A GEOPHYSICAL BACKGROUND,
Newcastle-upon-Tyne Univ. (England). School of Physics.
For primary bibliographic entry see Field 07C.
W70-07681

BATHYMETRY AND CONTINUOUS SEISMIC PROFILES OF THE HOT BRINE REGION OF THE RED SEA,
Woods Hole Oceanographic Institution, Mass., and Alpine Geophysical Associates, Inc., Norwood, N.J.
David A. Ross, Earl E. Hays, and Frank C. Allstrom.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 82-97, 1969. 16 p, 7 fig, 21 ref. NSF Grant GA-584.

Descriptors: *Sounding, *Oceanography, *Brines, Density stratification, Geophysics, Saline water, Mineralogy, Stratigraphy, Seismic studies.
Identifiers: *Red Sea, Hot brines.

A detailed bathymetric and geophysical study has been made of the three known deeps in the hot brine region of the central rift valley of the Red Sea. Continuous seismic profiling produced a distinct reflection from the hot brine-normal sea water contact in the Atlantis II and Discovery Deeps. The deeps are covered with a thin veneer of heavy-metal rich sediments. A major portion of the Atlantis II Deep contains more than 20m of heavy metal deposits. The sediment distribution in the brine area is compatible with a brine source in the Atlantis II Deep and periodic overflows into Chain and Discovery Deeps at some time in the past. A subsurface seismic reflector postulated to be an unconformity of late Miocene or early pliocene age is common to records from the flanks of the deeps. (See also W70-07394) (Knapp-USGS)
W70-07682

THERMAL MEASUREMENTS IN THE RED SEA HOT BRINE POOLS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Geology and Geophysics.
Albert J. Erickson, and Gene Simmons.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 114-121, 1969. 8 p, 5 fig, 2 tab, 20 ref. ONR Contract Nonr 1841 (74).

Descriptors: *Brines, *Saltine water, *Density stratification, *Water temperature, Sampling, Sounding, Oceanography, Hot springs, Geothermal studies, Saline water systems, Bottom sediments, Exploration, Surveys.
Identifiers: *Red Sea, Hot brines.

Fourteen thermal gradient measurements in the sediments beneath the Atlantis II Deep show large temperature variations both with location in the deep and vertically within individual measurements. Maximum sediment temperature observed was 62.3 deg C. Thermal gradients ranging from 3.75 deg C/m (hotter at depth) to --0.87 deg C/m (cooler at depth) were found, with a tendency for gradients in regions of high absolute temperature to be small or slightly negative. The average measured conductive heat flux into the 56 deg C water of 15 to 20 microcal/sq cm sec is inadequate to provide the heat lost to the 44 deg C water above or to warm the 56 deg C water. Of possible heat transfer mechanisms considered, the uniform convection of hot brine through the sediment beneath the Atlantis II Deep appears most likely to be active now, although former periods of hydrothermal discharge are probable. (See also W70-07394) (Knapp-USGS)
W70-07683

GENERAL CIRCULATION OF WATER MASSES IN THE RED SEA,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02D.
W70-07684

HYDROGRAPHY OF THE RED SEA BRINES,
Woods Hole Oceanographic Institution, Mass.
P. G. Brewer, C. D. Densmore, R. Munns, and R. J. Stanley.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 138-147, 1969. 10 p, 6 fig, 9 tab, 12 ref.

Descriptors: *Brines, *Saline water, *Hydrography, *Oceanography, *Water temperature, Mapping, Sounding, Surveys, Water chemistry, Sampling, Geochemistry, Geothermal studies, Saline water systems, Bottom sediments, Mineralogy, Density stratification.
Identifiers: *Red Sea, Hot brines.

The temperature and salinity characteristics of the Red Sea brines and their overlying waters are discussed, and data from the 1966 CHAIN cruise are presented. Most papers on this subject have reported 'salinity' values derived from volumetric dilution of the sample with distilled water and conductometric measurement of the dilute sample. The errors in this procedure are described, and the true salinity of a number of samples has been measured. Layering in the brines is discussed. Some practical difficulties of sampling in the deeps are outlined. (See also W70-07394). (Knapp-USGS)
W70-07685

TEMPERATURE STRUCTURE OF THE RED SEA BRINES,
Woods Hole Oceanographic Institution, Mass.
David A. Ross.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 148-152, 1969. 5 p, 2 fig, 2 tab, 17 ref.

Descriptors: *Brines, *Water temperature, *Sounding, *Sea water, *Density stratification, Thermal stratification, Oceanography, Water chemistry, Geochemistry, Hot springs, Geothermal studies, Saline water systems, Bottom sediments, Surveys.
Identifiers: *Red Sea, Hot Brines.

Temperature measurements obtained by a temperature telemetering pinger show a stratification in the hot brines of the Red Sea. In the Atlantis II Deep a 44 deg C water, which starts at a depth of 2,009m and has a thickness of 28m, overlies the bottom 56 deg C water. The interface between these layers is sharp and only about 5 m thick. In the Discovery Deep a 4m thick 36 deg C water overlies a bottom 44 deg C water. The interface between these layers is not as sharp as that of the Atlantis II Deep. The Chain Deep has water of at least 34 deg C. Layering may be present; however, the deepest part of this hole was not reached. (See also W70-07394). (Knapp-USGS)
W70-07686

SUSPENDED MATTER IN THE RED SEA BRINES AND ITS DETECTION BY LIGHT SCATTERING,
Lamont Geological Observatory; Palisades, N.Y.; and Woods Hole Oceanographic Inst., Mass.
William B. F. Ryan, Edwards M. Thorndike, Maurice Ewing, and David A. Ross.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 153-157, 1969. 5 p, 3 fig, 1 tab, 11 ref. ONR Contract N00014-67-A-0108-0004.

Descriptors: *Water chemistry, *Chemical precipitation, *Mineralogy, *Brines, Oceanography, Sea water, Colloids, Suspended load, Sampling, Instrumentation, Hot springs, Saline water systems, Bottom sediments, Exploration, Density stratification.
Identifiers: *Red Sea, Hot brines.

A dense layer of suspended particulate matter exists below a depth of 1,900m in the Atlantis II Deep in the Red Sea. This layer was detected with a light scattering meter (nephelometer) at two locations within this deep and was found to conform generally to the zone of hot brines. The nepheloid layer scatters light with a constant intensity except for a few very thin internal layers of greater light scattering which correlate with the interface between the different temperature and salinity brines. The intensity of light scattering is found to increase gradually over an interval of eighty meters in the transition zone between the hot brine and the normal Red Sea deep water. The particles which produce the light scattering are interpreted as the colloidal suspensions and mineral precipitates created by the interaction of the reducing, acidic, and metal-containing hot brine with the oxidizing and alkaline overlying normal Red Sea deep water. (See also W70-07394). (Knapp-USGS)
W70-07687

TEMPERATURE MEASUREMENTS IN THE BOTTOM LAYERS OF THE RED SEA BRINES,
Cambridge Univ. (England). Dept. of Geodesy and Geophysics.
David T. Pugh.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc. p 158-163, 1969. 6 p, 3 fig, 14 ref.

Descriptors: *Water temperature, *Density stratification , *Brines, Sea water, Geothermal studies, Oceanography, Saline water, Sounding, Surveys, Hot springs, Bottom sediments.
Identifiers: *Red Sea, Hot brines.

Detailed measurements of temperatures in the water layers immediately above the sediments in Atlantis II and Discovery Deeps are presented. In the bottom 60m of Discovery Deep there is a cooling of 0.5 deg C as the sediment is approached; above 60m the temperature gradient is adiabatic except for a discrete temperature change at 80m. The water column at the bottom is stable. These results suggest periodic outflow of hot saline water from Atlantis II Deep into Discovery Deep. (See also W70-07394). (Knapp-USGS)
W70-07688

A PHYSICAL INTERPRETATION OF THE OBSERVATIONS OF HOT BRINE LAYERS IN THE RED SEA,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
J. S. Turner.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc., p 164-173, 1969. 10 p, 1 fig, 3 tab, 21 ref.

Descriptors: *Brines, *Water temperature, *Density stratification, *Hot springs, *Laboratory, Tests, Model studies, Geochemistry, Geothermal studies, Oceanography, Sounding, Exploration, Saline water, Diffusion, Convection, Water chemistry, Sea water, Bottom sediments.
Identifiers: *Red Sea, Hot brines.

The observed temperature structure of the Red Sea brines, which occur as well-mixed layers separated by sharp interfaces, is compared with other natural examples of layering and also with laboratory experiments designed to study the phenomenon. The existence of such layers is characteristic of liquids which are stabilized with salt but are made unstable by heating from below. Various possible mechanisms for their formation and maintenance are evaluated from a physical point of view. The available evidence supports the idea that the source of the brines is in the Atlantis II Deep, which overflowed into the other holes in recent times. (See also W70-07394) (Knapp-USGS)
W70-07689

A NOTE ON THE CHEMICAL COMPOSITION OF THE RED SEA BRINES,
Woods Hole Oceanographic Institution, Mass.
Peter G. Brewer, and Derek W. Spencer.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc., p 174-179, 1969. 6 p, 6 tab, 14 ref. NSF Contract No GA-584.

Descriptors: *Brines, *Water chemistry, *Hot springs, *Sea water, Saline water, Mixing, Density stratification, Manganese, Iron, Salinity, Chemical precipitation, Bottom sediments, Chemical analysis, Water analysis.
Identifiers: *Red Sea, Hot brines.

Samples of brine from the Atlantis II Deep, the Discovery Deep, and the layer of 44 deg C brine overlying the Atlantis II Deep, have been analyzed for the major, and some minor, components. The data are compared with those of other workers and some significant differences are noted. In particular, the Atlantis II brine has been found to have different concentrations of chloride, bromide, sodium and potassium than previously reported. The major ion compositions of the Atlantis II brine and Discovery brine are similar. The chemical composition of the 44 deg C brine in the Atlantis II Deep suggests that it may have formed from the mixing of the highly saline deeper brine and the overlying Red Sea Bottom Water. This brine is rich in manganese but low in iron, owing to precipitation of ferric hydroxide at the 56 deg/44 interface. (See also W70-07394) (Knapp-USGS)
W70-07690

DISSOLVED ARGON, NITROGEN AND TOTAL CARBONATE IN THE RED SEA BRINES,
Scripps Institution of Oceanography, La Jolla, Calif.
R. F. Weiss.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 254-260, 1969. 7 p, 1 fig, 1 tab, 26 ref. NSF Grant GA-666.

Descriptors: *Brines, *Solutes, *Gases, *Sea water, *Geochemistry, Water chemistry, Water analysis, Carbonates, Carbon dioxide, Oxygen, Nitrogen, Stable isotopes.
Identifiers: *Red Sea, Hot brines.

Concentrations of argon, nitrogen, and total carbonate in the Atlantis II and Discovery Red Sea brines were measured by gas chromatography. The isotopic composition of the carbon in the total carbonate of both brines were also measured. Nitrogen and argon are supersaturated by about 250 per cent relative to their solubilities in the brine in equilibrium with the atmosphere. The argon and nitrogen concentrations in the two brines differ by about 10 per cent and 3 per cent, respectively. Large differences were found in total carbonate concentration and in carbon isotopic composition. The possibility that the brines were formed by evaporation, either during some early stage or in coastal lagoons, is discounted by the dissolved gas results. The argon and nitrogen data are consistent with an origin in which the brines were formed from high temperature Red Sea water with the addition of biogenic nitrogen. Water of sufficiently high temperature to be thus considered as a source of the brines can be found only in shallow coastal areas and in the surface and near-surface waters at the southern end of the Red Sea. (See also W70-07394) (Knapp-USGS)
W70-07691

BACTERIAL SULFATE REDUCTION IN THE RED SEA HOT BRINES,
Woods Hole Oceanographic Institution, Mass.
Hans G. Truper.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 263-271, 1969. 9 p, 1 fig, 3 tab, 45 ref. NSF Grants GB-5199, GB-6314 and GA-584.

Descriptors: *Brines, *Sulfates, *Sulfur bacteria, *Sea water, *Hot springs, Sulfur, Water chemistry, Aquatic environment, Dissolved oxygen, Water temperature, Bottom sediments.
Identifiers: *Red Sea, *Hot brines.

Fresh Red Sea brine samples and mud samples from cores were taken under sterile conditions. Enrichment media for sulfate-reducing and nitrate-reducing bacteria were inoculated with these samples and incubated at room temperature and the respective brine temperature. No positive development was found in cultures inoculated from brines or core muds from the brine area. Only one of five cores from outside the brine area contained sulfate-reducing bacteria, of which two strains were isolate. Water samples from the brine/seawater transition zone in the Atlantis II Deep also resulted in positive enrichments, of which three strains of sulfate-reducing bacteria were isolate. No nitrate-reducing bacteria could be enriched from any of the samples. Only sulfate-reducing bacteria from the Atlantis II Deep brine/seawater transition zone grew well at 10 per cent NaC1/44 deg C and 1/2 concentrated brine 35 deg C. (See also W70-07394) (Knapp-USGS)
W70-07692

THE STERILE HOT BRINES OF THE RED SEA,
Woods Hole Oceanographic Institution, Mass.
Stanley W. Watson, and John B. Waterbury.
In: Hot Brines: and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc., p 272-281, 1969. 10 p, 1 fig, 6 tab, 12 ref. NSF Grant GA-584.

Descriptors: *Brines, *Sulfates, *Mineralogy, *Sulfur bacteria, *Sea water, Hot springs, Sulfur, Water chemistry, Aquatic environment, Bottom sediments, Water temperature.
Identifiers: *Red Sea, Hot brines.

The brines of the Atlantis II and Discovery Deeps, their sediments and the water overlying these Red Sea brines were examined for the presence or absence of bacteria. No bacteria were found in the Atlantis II sediments and brines, but they were present in the overlying transition and normal 22 deg waters. The sulfate reducing bacteria in this transition layer may account for the sulfur fractionation found in the metal sulfides in the sediments. In the Discovery Deep, bacteria were present in the sediment but were not demonstrated within the brines. The high temperature, salinity and metal concentrations in the Atlantis II brines are thought to act synergistically, preventing the growth of bacteria. The lower heavy metal concentration in Discovery Deep may make conditions slightly less hostile to life and permit the growth of bacteria in the sediments. (See also W70-07394) (Knapp-USGS)
W70-07693

RADIOCARBON CHRONOLOGY OF RED SEA SEDIMENTS,
Woods Hole Oceanographic Institution, Mass.; and Lamont Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 02J.
W70-07694

RED SEA GEOTHERMAL BRINE DEPOSITS: THEIR MINERALOGY CHEMISTRY, AND GENESIS,
Woods Hole Oceanographic Institution, Mass.
James L. Bischoff.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 368-401, 1969. 34 p, 11 fig, 3 tab, 40 ref. NSF Grant GA-584.

Descriptors: *Brines, *Chemical precipitation, *Bottom sediments, *Sea water, *Water chemistry, Mineralogy, Mixing, Hot springs, Saline water, Geochemistry, Geothermal studies, Sampling, Deposition (Sediments).
Identifiers: *Red Sea, *Hot brines.

Chemical and mineralogical analyses were performed on samples from ten specially selected cores from the Red Sea geothermal deposit. The deposit was divided into seven bedded and laterally correlative facies as follows: (1) detrital; (2) iron-montmorillonite; (3) goethite-amorphous; (4) sulfide; (5) manganosiderite; (6) anhydrite; and (7) manganite. Distribution of the facies, their unconsolidated nature, and age relations indicate that the solids were precipitated out of the overlying brine column, that the area of brine discharge is very local within the Atlantis II Deep, and that the chemistry of the brine has changed considerably with time. Mechanisms of precipitation include simple cooling of subterranean brine as it discharges into the bottom of the Atlantis II Deep and mixing of the brine with the overlying sea water. (See also W70-07394) (Knapp-USGS)
W70-07696

GEOTHITE-HEMATITE STABILITY RELATIONS WITH RELEVANCE TO SEA WATER AND THE RED SEA BRINE SYSTEM,
Woods Hole Oceanographic Institution, Mass.
James L. Bischoff.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc, p 402-406, 1969. 5 p, 1 fig, 9 ref. NSF Grant GA-584.

Descriptors: *Geochemistry, *Sea water, *Iron compounds, *Oxides, *Brines, Oxidation, Chemical reactions, Chemical precipitation, Equilibrium, Oxidation-reduction potential, Hydrate processes, Water chemistry.
Identifiers: *Red Sea, Hot brines.

Goethite is the dominant ferric mineral in all cores from the Red Sea brine deposits with the exception of core station 84 within the Atlantis II Deep where hematite has been transformed from original goethite and limonite. Review of existent thermochemical data allows construction of an approximate stability diagram relating fields of goethite, hematite, and water to T and water activity at 1 to 200 atmospheres total pressure, conditions relevant to sea water and the Red Sea brines. All conceivable 'normal' submarine environments and the Atlantis II brines plot well within the goethite water stability field. Transformation of goethite to hematite at station 84 appears to result from a local temperature anomaly, suggesting a close proximity to a zone of brine discharge. (See also W70-07394) (Knapp-USGS)
W70-07697

CHEMICAL COMPOSITION OF SEDIMENTS AND INTERSTITIAL BRINES FROM THE ATLANTIS II, DISCOVERY AND CHAIN DEEPS,
Kennecott Copper Corp., Salt Lake City, Utah. Exploration Services, and Scripps Institution of Oceanography, La Jolla, Calif
Ruth L. Hendricks, Frederic B. Reisbick, Edwin J. Mahaffey, D. Blair Roberts, and Melvin N. A. Peterson
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea, published by Springer-Verlag New York Inc, p 407-440, 1969. 34 p, 8 tab, 1 ref

Descriptors: *Bottom sediments, *Brines, *Sea water, *Hot springs, Oceanography, Water chemistry, Chemical precipitation, Mineralogy, Sampling.
Identifiers: *Red Sea, Hot brines.

A total of 110 Red Sea brine-deep sediment samples and 58 interstitial water samples have been analyzed by wet chemical and optical spectrographic methods. Most of the interstitial water are essentially saturated with respect to sodium chloride and are enriched in iron, copper, zinc and other heavy metals. The sediment samples show a wide variation in physical appearance and in chemical composition, from oxidized red muds to dark sulfide-rich muds and a few light-colored carbonate-rich samples. Extreme variations in composition are found between adjacent sample sites, and considerable variation is found even within different splits from the same core. Vertical variations in the cores are also extreme, sometimes within a few centimeters of depth. Some of the sulfide-rich parts of this deposit contain high concentrations of zinc, copper and other heavy metals, but the average metal content of the deposits is much lower than would be indicated by these few high values. (See also W70-07394) (Knapp-USGS)
W70-07698

MICROSCOPIC AND ELECTRON BEAM MICROPROBE STUDY OF SULFIDE MINERALS IN RED SEA MUD SAMPLES,
Kennecott Copper Corp., Salt Lake City, Utah.
For primary bibliographic entry see Field 02J.
W70-07699

MINERALOGY AND MICROPALEONTOLOGY OF A GOETHITE-BEARING RED SEA CORE,
Washington State Univ., Pullman. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-07700

MAGNETIC PROPERTIES OF MINERALS FROM THE RED SEA THERMAL BRINES,
Massachusetts Inst. of Tech., Cambridge; and Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02J.
W70-07701

SULFUR ISOTOPE STUDIES ON RED SEA GEOTHERMAL BRINES AND SEDIMENTS,
California Univ., Los Angeles. Dept. of Geology; and California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
For primary bibliographic entry see Field 02J.
W70-07702

LEAD ISOTOPES MEASUREMENTS ON SEDIMENTS FROM ATLANTIS II AND DISCOVERY DEEP AREAS,
Australian National Univ., Canberra.
For primary bibliographic entry see Field 02J.
W70-07703

URANIUM SERIES ISOTPES IN SEDIMENTS FROM THE RED SEA HOT-BRINE AREA,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02J.
W70-07704

COMPARISON BETWEEN RED SEA DEPOSITS AND OLDER IRONSTONE AND IRON-FORMATION,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-07705

ECONOMIC POTENTIAL OF THE RED SEA HEAVY METAL DEPOSITS,
Woods Hole Oceanographic Institution, Mass.; and Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02J.
W70-07706

DYNAMICS OF AN ARIZONA TRAVERTINE-FORMING STREAM,
Arizona State Univ., Tempe.
For primary bibliographic entry see Field 02F.
W70-07781

EVOLUTION OF INTERSTITIAL WATERS IN RECENT ALASKAN MARINE SEDIMENTS,
Alaska Univ., College. Inst. of Marine Science.
G. D. Sharma.
Journal of Sedimentary Petrology, Vol 40, No 2, p 722-733, June 1970. 12 p, 11 fig, 3 tab, 34 ref.

Descriptors: *Diagenesis, *Glacial drift, *Connate water, *Alaska, *Water chemistry, Solutes, Leaching, Water chemistry, Porosity, Clays, Clay minerals, Mineralogy, Glaciers, Sea water.
Identifiers: Gulf of Alaska.

Recent glacio-marine sediments from southeast Alaska were examined in a study of diagenesis in sediments and pore solutions during transfer from the fluvio-glacial to the marine environment. Large amounts of sediments with minimal chemical weathering are deposited in the fiords, channels and bays in this area. Sodium ion concentration in the interstitial waters varies with depth and between cores. Removal of sodium and enrichment of calcium in sea water occurs during early stages of sediment-sea water interaction. Removal of magnesium accompanied by further removal of sodium from sea water results from thorough mixing of sediments and sea water during transport. The changes in the interstitial waters are primarily due to ion exchange between sediments and trapped pore waters. Sediments containing larger silt fractions remove less sodium from trapped waters than those containing less silt. Particle size distribution, range, mineralogy, and the exposure time of sediments appear to control the nature and the content of ion exchange between sediments and sea water. (Knapp-USGS)
W70-07891

U-234/U-238 DISEQUILIBRIUM AS AN AID TO HYDROLOGIC STUDY OF THE FLORIDAN AQUIFER,
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02F.
W70-07907

API RECOMMENDED PRACTICE FOR ANALYSIS OF OIL-FIELD WATERS.
American Petroleum Inst., Dallas, Tex. Div of Production.

API RP 45, American Petroleum Institute Official Publication, 2nd Edition, November 1968. 49 p.

Descriptors: *Chemical analysis, *Water chemistry, *Oil industry, *Analytical techniques, Colorimetry, Flame photometry, Gravimetric analysis, Photometry, Spectroscopy, Sampling, Data collections.
Identifiers: Oil-field waters.

Standard methods of analysis of oil-field waters as developed and recommended by the American Petroleum Institute are presented in a detailed laboratory practice manual. Methods discussed include wet chemical, spectroscopic, photometric, electrochemical, and gravimetric procedures. Analytical quality, sampling methods, data uses, reports, computer data-processing, precision, accuracy, reliability, and significance of results are explained. (Knapp-USGS)
W70-07908

METHODS FOR COLLECTION AND ANALYSIS OF WATER SAMPLES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-07911

THE ADAPTATION OF PLANKTON ALGAE. V. VARIATION IN THE PHOTOSYNTHETIC CHARACTERISTICS OF SKELETONEMA COSTATUM CELLS GROWN AT LOW LIGHT INTENSITY,
Royal Danish School of Pharmacy, Copenhagen. Dept. of Botany.
Erik G. Jorgensen.
Physiologia Plantarum, Vol 23, No 1, p 11-17, 1970. 3 fig, 2 tab, 11 ref.

Descriptors: *Photosynthesis, *Diatoms, Pigments, Light, Primary productivity, Sea water, Oceans, Plankton, Laboratory tests, Chlorophyll.
Identifiers: *Skeletonema costatum, Auxospore formation, Cells, Chlorophylla.

The average cells of the diatom Skeletonema costatum, maintained at 3 klux continuous illumination and 20C, decreased their diameter from 8 to 3.5 microns during 6 month vegetative period. A significant correlation was established between cell volume, the rate of photosynthesis, and the content of chlorophyll a. The rate of milligrams carbon per milligram of chlorophyll a/ hour at 1 klux varied between 0.40 and 0.70. The corresponding values for cells deficient in phosphorus or nitrogen were 0.19 and 0.09, respectively. (Wilde-Wisconsin)
W70-08110

THE CHEMICAL ECOLOGY OF THREE SPECIES OF MYRIOPHYLLUM (ANGIOSPERMAE, HALORAGACEAE),
Yale Univ., new Haven, Conn. Dept. of Biology.
G. E. Hutchinson.
Limnology and Oceanography, Vol 15, No 1, p 1-5, 1970. 3 fig, 2 tab, 10 ref.

Descriptors: *Ecology, *Chemical properties, Hydrogen ion concentration, Calcium, Bicarbonates, Photosynthesis, Electrolytes, Hardness (Water), Conductivity, Lakes, Water properties.
Identifiers: *Chemical ecology, *Myriophyllum, Angiospermae, Haloragaceae, Myriophyllum alterniflorum, Myriophyllum spicatum, Myriophyllum verticillatum, Soft water, Sweden, Potamogeton praelongus, Potamogeton pectinatus, Potamogeton alpinus, Potamogeton natans, Potamogeton gramineus, Potamogeton perfoliatus, Myriophyllum exalbescens.

At least four parameters, varying in a correlative way, may affect the physiological processes of plants independently, namely pH, calcium concentration, bicarbonate concentration, and total electrolyte content. Analysis of data published by Lohammar indicates that Myriophyllum alterniflorum occurs in moderately acid, neutral, or slightly alkaline water. Both Myriophyllum spicatum and Myriophyllum verticillatum extend into waters having higher calcium contents than are apparently tolerated by M alterniflorum. Myriophyllum verticillatum has a propensity to occur in waters having a lower pH than those inhabited by M spicatum. The difference is significant and may be correlated with M spicatum's ability, and M verticillatum's inability to use the bicarbonate ion as carbon source in photosynthesis. In a region of northern Sweden, where the lakes did not contain M verticillatum, the soft-water part of its niche may be occupied by M spicatum. Examination of other genera containing two or more species fails to show other clear-cut cases of pH limitation in the alkaline waters studied by Lohammar; usually the more calciphil species seem to require and thrive at high calcium concentrations. It is possible that in very soft water low pH may be limiting. (Jones-Wisconsin)
W70-08112

PHOSPHATE ABSORPTION IN EELGRASS,
Alaska Univ., College. Inst. of Marine Science.
C. Peter McRoy, and Robert J. Barsdate.
Limnology and Oceanography, Vol 15, No 1, p 6-13, 1970. 4 fig, 4 tab, 23 ref.

Descriptors: *Phosphates, *Absorption, Phosphorus radioisotopes, Estuarine environment, Cycling nutrients, Alaska, Waterfowl, Fish, Invertebrates, Tracers, Aquatic plants, Sediments, Sea water, Leaves, Laboratory tests.
Identifiers: *Eelgrass, Zostera marina L, Izembek Lagoon (Alaska), Root hairs, Transport rate, Uptake, Phosphate absorption.

Eelgrass and its associated community is important in the biogeochemical cycle of nutrients in the ocean. Eelgrass is the principal food of hundreds of thousands of migratory waterfowl in Alaska. Additionally fresh or detrital eelgrass feeds numerous species of commercially harvested invertebrates and fishes. The absorption of phosphate by eelgrass (Zostera marina L) was studied using phosphorus-32 in a partitioned container where leaves were separated from roots and rhizomes. The eelgrass uptake of phosphorus-32 was also studied in the natural, undisturbed environment to supplement the laboratory experiments. Absorption, greatest in light, occurred through both leaves and roots, and the absorbed phosphorus was transported rapidly to all parts of the plant. Apparently eelgrass can use phosphate from sediments and from water. Phosphate removed from solution by the roots and rhizomes was returned in part to the surrounding water through the leaves, suggesting that in nature seagrass may act either as a sink or as a source for dissolved phosphorus in estuarine waters. The phosphate absorption depends on metabolism as well as on a physical process of absorption-exchange. (Jones-Wisconsin)
W70-08114

2L. Estuaries

DEVELOPMENT OF THE ASTORIA CANYON-FAN PHYSIOGRAPHY AND COMPARISON WITH SIMILAR SYSTEMS,
Geological Survey, Menlo Park, Calif. Office of Marine Geology and Hydrology; and Oregon State Univ., Corvallis. Dept. of Oceanography.
C. Hans Nelson, P. R. Carlson, J. V. Byrne, and Tau Rho Alpha.
Marine Geology Vol 8, No 3-4, p 259-291, Apr 1970. 33 p, 10 fig, 3 tab, 64 ref. ONR Contract Nonr 1286 (10).

Descriptors: *Bottom sediments, *Continental slope, *Columbia River, *Turbidity currents, *Marine geology, Washington, Oregon, Deposition (Sediments), Sedimentary structures, Stratigraphy, Pacific Ocean, Pleistocene epoch, Deltas, Currents (Water), Erosion, Sediment transport, Suspended load, Sediments.
Identifiers: *Submarine canyons.

A detailed bathymetric study of Astoria Canyon and Astoria Fan off the Oregon-Washington coast provides a model for typical submarine canyon-fan systems. The present canyon head is 9 miles west of the Columbia River mouth but buried Pleistocene channels appear to have connected the two features in the past. The canyon, which is distinguished by its relief, V-shaped profiles, and numerous tributaries, winds sinuously and is coincident with apparent structural trends across the continental shelf and slope. At the fan apex, the canyon mouth merges smoothly into Astoria Channel, which is characterized by its U-shaped profiles, lower walls of even height, and levee development. Similarity of Astoria Canyon-Fan system with other deep-sea fan and alluvial fan systems, suggests the hypothesis that size of drainage basin, sediment size, and sediment load control the size, gradient, and valley development of any fan system. Cutting of Astoria Canyon and the deposition of the unconsolidated sediment layer forming Astoria Fan could have been cut during the Pleistocene. A similar history can be suggested for other major submarine canyon-fan systems. (Knapp-USGS)
W70-07652

SUBMARINE VALLEY SYSTEMS AROUND THE CORAL SEA BASIN (AUSTRALIA),
Scripps Institution of Oceanography, La Jolla, Calif.
Edward L. Winterer.
Marine Geology, Vol 8, No 3-4, p 229-244, Apr 1970. 16 p, 9 fig, 13 ref. NSF Grant GA681.

Descriptors: *Bottom sediments, *Turbidity currents, *Deposition (Sediments), *Pacific Ocean, *Marine geology, Stratigraphy, Sedimentary structures, Provenance, Deltas, Currents (Water), Erosion, Sediment transport, Suspended load, Bed load, Sands, Mud.
Identifiers: *Australia, *Submarine valleys, Submarine canyons, Coral Sea.

Several major and a host of minor submarine valleys and canyons lead into the deep (4,650 m) Coral Sea basin from the surrounding land, reef, and submarine plateau areas. An integrated submarine drainage system collects sediment from nearly the entire Papuan coast and channels it onto the floor of the basin. The Bligh System drains a 900 km sweep of the Great Barrier Reef coast of Queensland and parts of the Queensland Submarine Plateau. Reflection profiles of the valleys show that they are mainly located in structural depressions, but that the submarine relief has been further accentuated by erosional entrenchment of the valleys into older, probably pelagic, sediments to a depth of as much as 750 m. Since the time of the entrenchment, the valleys and many canyons have been backfilled by as much as 500 m of sediment. The valleys may be thought of as graded, and their filling is assigned to adjustments in the long profiles of the valleys as the Coral Sea basin fills with sediment. (Knapp-USGS)
W70-07653

TRANSPORT AND DEPOSITION OF HOLOCENE SEDIMENT ON LA JOLLA DEEP SEA FAN, CALIFORNIA,
Scripps Institution of Oceanography, La Jolla, Calif.
D. J. W. Piper.
Marine Geology, Vol 8, No 3-4, p 211-227, Apr 1970. 17 p, 7 fig, 2 tab, 25 ref. ONR Contract Nonr 2216 (23).

Descriptors: *Bottom sediments, *Turbidity currents, *Continental slope, *Deposition (Sediments), *California, Sedimentary structures, Stratigraphy, Density currents, Deltas, Currents (Water), Erosion, Sediment transport, Suspended load, Bed load, Sands, Mud, Marine geology.
Identifiers: *Submarine canyons.

Near-surface sediments on La Jolla Fan have been studied using over 100 cores, mostly 60 cm long box cores. Sediment distribution on the fan is apparently related to processes acting along the prominent fan valley, which cuts deeply into Pleistocene sediments. The Holocene sediments in the fan valley consist of sands with some interbedding muds; a few of these muds are in thin beds in which the low sand content is graded. All the other muds are bioturbated. On the open fan away from the fan valley, sands are thinner and rarer. Sedimentary structures within the sands suggest they were deposited from relatively powerful currents, of gradually declining competence, carrying large amounts of sediment in suspension; these are thought to be turbidity currents. Much of the mud also appears to have been deposited from turbidity currents. The Holocene sediments on the fan are about 2 m thick, indicating that about 90% of the sediment being supplied to La Jolla Canyon is bypassing the fan. (Knapp-USGS)
W70-07654

RESEARCH NEEDS ON THERMAL AND SEDIMENTARY POLLUTION IN TIDAL WATERS,
For primary bibliographic entry see Field 05A.
W70-07656

THE ENVIRONMENTAL SIGNIFICANCE OF IRON-STAINED QUARTZ GRAINS ON THE SOUTHEASTERN UNITED STATES ATLANTIC SHELF,
Duke Univ., Durham, N.C. Dept. of Geology; and Duke Univ., Beaufort, N.C. Marine Lab.

James B. Judd, William C. Smith, and Orrin H. Pilkey.
Marine Geology, Vol 8, No 5, p 355-362, May 1970. 8 p, 5 fig, 13 ref.

Descriptors: *Sands, *Continental shelf, *Quartz, *Iron oxides, *Provenance, Bottom sediments, Diagenesis, Sediment transport, Littoral drift, Rivers, Deltas, Beaches.
Identifiers: Iron-stained quartz.

An examination of approximately 1,000 continental shelf, beach and river samples from the Atlantic southeastern United States shows that there are significant differences in the percentages of iron-stained quartz grains in two sand-size fractions in each of these major environments. More iron-stained quartz is found in sediments of rivers draining the Piedmont province than those draining the coastal plain. The presence of iron-stained quartz on the shelf may be due in large part to the contributions of rivers during the Pleistocene rather than subaerial weathering of shelf sediments, as indicated by shelf abundance anomalies related to river mouths. These same shelf anomalies are evidence of lack of extensive lateral transportation of sediment on the shelf. Abrasion is apparently not effective in removing the iron coating from the quartz grains in any environment, even in the beach environment. (Knapp-USGS)
W70-07665

COASTAL CURRENTS AND MASS TRANSPORT OF SURFACE SEDIMENTS OVER THE SHELF REGIONS OF MONTEREY BAY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Office of Marine Geology and Hydrology.
Stephen C. Wolf.
Marine Geology, Vol 8, No 5, p 321-336, May 1970. 16 p, 6 fig, 26 ref.

Descriptors: *Sediment transport, *Bottom sediments, *Currents (Water), *Littoral drift, California, Sediment distribution, Ocean currents, Tides, Shores, Deltas.
Identifiers: Monterey Bay (Calif), Submarine canyons.

In Monterey Bay, California the highest concentrations of medium and fine sands occur nearshore between 10 and 30 fathoms. Silt and clay accumulate in greater depths. Contours of median diameter roughly parallel the isobaths. Fine-grained materials are supplied to the bay region from erosion of cliffs, from sediment laden river discharge, and from continual reworking of widespread sea floor sediments. These sediments in turn are picked up by coastal currents and distributed over the shelf regions by present day current regimes. Studies of bottom currents over the shelf regions and in Monterey Canyon have revealed patterns which vary with seasonal changes. Irregular current flow in the canyon indicates a complex current structure with frequent shifts in direction over very short periods of time. Changes in current regimes are reflected in the patterns of sediment distribution and transport. Sediment transport is chiefly parallel to the isobaths, particularly on the North and South Shelf regions. Some sediments are also transported offshore by rip currents and other agencies and deposited in deeper, quieter waters. Supply of sediments to the canyon head results in over-filling and steepening with subsequent mass movement of sediments seaward followed by deposition in channels and on the broad deep sea fan. (Knapp-USGS)
W70-07666

HYDRODYNAMIC STUDIES OF TIDE GAUGES,
Liverpool Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 07A.
W70-07675

UTILIZATION OF PHYSICAL AND MATHEMATICAL MODELS IN MARINE WATER RESOURCES RESEARCH, PLANNING AND MANAGEMENT,
Virginia Inst. of Marine Science, Gloucester Point.
W. J. Hargis, Jr., Yee-chang Wang, Paul V. Hyer, E. P. Ruzecki, and R. Moncure.
Available from the Clearinghouse as PB-192 630, $3.00 in paper copy, $0.65 in microfiche. Final Report, June 1970. 118 p, 7 tab, 20 fig, 40 ref. OWRR Projects C-1214 and C-1428.

Descriptors: *Estuaries, *Hydraulic models, *Mathematical models, *Instrumentation, *Model studies, Physical models, Mixing, Diffusion, Dispersion, *Circulation, Computer simulation, Virginia, Current meters, *Application methods, Dye releases, Oysters, Flow.
Identifiers: *James River estuary, Salinometer.

During the period 1 September 1967 to 30 September 1969, hydraulic model studies, mathematical and computer studies, and instrument and technique development were studied. An investigation was made into the stability and reproducibility of an estuarine hydraulic model. Studies were made of the dispension of point-source dye releases in an estuarine hydraulic model, and of the applicability of the results to the release of disease-resistant seed oysters. Analytical studies were made of diffusion in estuaries and of the integro-differential equations for estuarine flow. Computer studies were made of two-dimensional estuarine circulation and of solution of the one-dimensional equations by analogue simulation. Development was carried out on an automated recording salinometer and on a miniaturized current meter for hydraulic models. Computer techniques were developed for use in hydraulic model work.
W70-07801

EVOLUTION OF INTERSTITIAL WATERS IN RECENT ALASKAN MARINE SEDIMENTS,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02K.
W70-07891

MINERALOGY AND DISTRIBUTION OF CLAY SIZE SEDIMENT IN GLACIER BAY, ALASKA,
State Univ. Coll., Potsdam. Dept. of Geology; and Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02J.
W70-07895

RELATION OF SEA WATER TO FRESH WATER IN CARBONATE ROCKS IN COASTAL AREAS, WITH SPECIAL REFERENCE TO FLORIDA, U.S.A., AND CEPHALONIA (KEPHALLINIA), GREECE,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W70-07906

ESTUARINE OXYGEN RESOURCES--PHOTOSYNTHESIS AND REAERATION,
Central Coastal Regional Water Quality Control Board, San Luis Obispo, Calif.
Thomas E. Bailey.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA2, p 279-295, 1970. 4 fig, 5 tab, 31 ref.

Descriptors: *Estuaries, *Oxygenation, *Photosynthesis, *Reaeration, Chlorophyll, Phytoplankton, Sanitary engineering, California, Dissolved oxygen, Solar radiation, Light intensity, Depth, Temperature, Seasonal, Diffusion, Hydraulics, Tides, Velocity, Eutrophication, Indicators, Methodology, Equations, California.
Identifiers: Sacramento-San Joaquin Estuary, Suisun Bay (Calif), Light extinction.

Maximum photosynthetic rates occurred throughout Sacramento-San Joaquin Estuary April through September. Photosynthesis was maximum in upstream estuarine areas, decreased longitudinally downstream, and increased in shallow embayments. Photosynthesis and directly related to phytoplankton populations and chlorophyll concentrations. An empirical equation estimating photosynthesis as function of chlorophyll concentration, solar intensity, light extinction coefficient, temperature and water depth can be the basis for mathematical models predicting photosynthesis under changing environmental conditions. Oxygen diffused into water column and atmosphere depending on oxygen saturation degree; observations show that diffusion rates were variable, that complex estuarine physical relationships existed influencing reaeration rates, and that empirical equations derived by other investigators were not directly applicable for calculating reaeration rates; independent direct measurements must be made to determine reliable reaeration and oxygen diffusion rates. The most significant finding of this work shows there is no adequate basis for extending numerical reaeration comparisons from one hydrodynamic system to any other. Data collected throughout estuary show that predictive reaeration coefficient equations do err by as much as two orders of magnitude. Predictive equations or models developed for application in shallow streams or artificial channels are appropriately used only in those identical watercourses. (Jones-Wisconsin)
W70-08103

PHOSPHATE ABSORPTION IN EELGRASS,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02K.
W70-08114

NUMERICAL ANALYSIS OF DISTRIBUTION OF FLOW AND THERMAL DIFFUSION CAUSED BY OUTFALL OF COOLING WATER,
Central Research Inst. of Electric Power Industry, Tokyo (Japan).
For primary bibliographic entry see Field 05B.
W70-08131

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PRELIMINARY COMMUNITY AND REGIONAL WATER SUPPLY DATA IN SUPPORT OF DESALTING PLANT PROJECTIONS,
Black and Veatch, Kansas City, Mo.
W. L. Patterson, and H. J. Lobb.
Report available for sale by the Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $2.50. Office of Saline Water Research and Development Progress Report No 519, Apr 1970. 212 p, 9 fig, 2 exhibit, 3 tab, 5 ref.

Descriptors: *Surveys, *Municipal water, *Water supply, *Water resources development, *Desalination, Planning, Data collections, Precipitation (Atmospheric), Project planning, Economic justification, Programs.
Identifiers: Desalination planning.

Basic water supply data needed for future evaluation and selection of promising saline water conversion opportunities are tabulated. Information is presented regarding the present and future supply situation of individual communities. Also presented is information on regional water plans with respect to provisions for municipal water supply. Saline water conversion as a source of municipal supply has potential for application in areas where water supply quality or adequacy is a problem. (Knapp-USGS)
W70-07650

A STUDY OF A SPECIFIC INFLUENCE OF DISSOLVED IONS ON THE STRUCTURE OF WATER,
Rocketdyne, Canoga Park, Calif.
For primary bibliographic entry see Field 01B.
W70-07651

DESIGN AND CONSTRUCTION OF THE WORLD'S LARGEST FLASH TYPE DESALTING PLANT AT TIJUANA, MEXICO,
Gordon F. Leitner.
Western Water and Power Symposium, Proceedings, p C1-C11, 1968. 3 fig, 4 ref.

Descriptors: *Desalination processes, *Water yield, *Brines, *Contracts, *Contract administration, Engineers estimates, Performance, Flash distillation, Procurement, Specifications, Standards, Economics, Employment, Projects, Budgeting, Costs, Cost-sharing, Evaluation, Water policy, Water supply, Water resources development, Water requirements, Governments, Electric power demand, Water costs.
Identifiers: *Turnkey contract, Brine temperature, Brine recirculation, Long tube design, Performance testing, Startup.

In 1956 about 50,000 gallons of water per day were produced by the then-existant flash type desalting plants. Using current construction plans for desalting plants, the author estimates an increase in unit capacity of 1000 times from 1956 to 1976. Administrative techniques of planning, design, and construction of existing facilities have involved either a joint venture on the part of designer-manufacturer firms and consulting engineering firms, or a lone venture on the part of the designer-manufacturer. Empirically, the former arrangement has been best for the client. A 'turnkey' contract is one in which the designer-manufacturer works in concert with the owner through the intermediary of a consulting engineering firm writing specifications and inspecting the work done. A number of existing desalting plants are described in terms of their capacity, planning, and contractual arrangements. An ongoing project involving an integrated stream electric plant and desalting plant in Tijuana, Mexico is described in depth. Comparative cost investigations, financing arrangements, technological details, labor and construction problems, and contractual arrangements are all examined. It is concluded, from the Tijuana experience, as well as that of other facilities, that the 'turnkey' contract is the best management procedure in this highly complex type of undertaking. (Casey-Arizona)
W70-07765

DESIGN AND OPERATION OF LARGE DESALTING PLANTS,
Robert A. Baker, Jr.
Water and Waste Treatment, Vol 12, No 11, p 356-360, Jan-Feb 1970. 5 p, 6 fig.

Descriptors: *Optimization, *Desalination plants, *Design, *Flash distillation, *Cost Economic efficiency, *Water quality.
Identifiers: Kuwait desalting plant, Point Loma plant, Guantanamo Bay.

The present state and future outlook for large water desalting plants were examined using advances in size and efficiency created over the past twelve years. American industry has made these impressive contributions to water desalting. Yet larger plants that realize the field economy of size available from a proven technology (i.e. flash distillation) to reduce cost of water for underdeveloped areas, are needed. The Kuwait land based desalting plant built in 1957 by Westinghouse was cited as an example of flash distillation. The basically simple design involved four stages. Holding down the first cost was more important in this case than designing for high operating efficiency. Since 1957 when the first Kuwait plant went into operation, three more were put into operation in 1968. They produce water for only a fraction of the cost attained in the first large desalting plant. Another plant built at Point Loma, near San Diego, California was designed for efficiency. It had thirty-six stages and operated it with either of two scale control systems. Another built at the Guatnanamo Bay Naval Base in Cuba was a dual-purpose water-desalting plant and optimized full efficiency as well as held down capital cost. Other plants were described which demonstrated continuing change for efficiency and economy. The optimum large plants of the future may incorporate other technologies of flash distillation, and thus produce not only multiple qualities of water, but also reprocess that water for re-use. (Kriss-Cornell)
W70-07854

OPTIMIZATION OF BASIC PARAMETERS OF THERMAL DESALTING PLANTS WITH ADIABATIC EVAPORATION,
A. I. Korneichev, A. V. Izvekov, and A. A. Myagkov.
Desalination, Vol 7, No 2, p 179-186, Feb 1970. 8 p, 4 fig.

Descriptors: *Optimization, *Desalination plants, Economic impact, Mathematical models, Equations.
Identifiers: Parameters, Adiabatic evaporation.

A method for complex optimization of the parameters of a multi-stage desalination plant with adiabatic evaporation or with instantaneous boiling up was presented. The computation of optimal parameters of single as well as dual purpose distillational desalination plants by the proposed method was proven not complicated. The problem of choosing the parameters was of primary importance so that the solution could have a high economic effect. Optimization of the parameters was a search for the optimal solution out of a large number of possible alternatives both as to the basic parameters of the working process, and as to special parameters and design solutions for individual plant elements. As a criterion of the optimal quality of the solution arrived at for single-and dual purpose desalting plants, the minimum specific computed expenditure on producing the distillate was taken. The equations for the mathematical model of a desalination plant with adiabatic evaporation were given. The outlined optimization method was said to be applicable to other types of desalination plants. (Kriss-Cornell)
W70-07860

OPTIMUM OPERATION OF DESALTING PLANTS AS A SUPPLEMENTAL SOURCE OF SAFE YIELD,
Utah Water Research Lab., Logan.
Calvin G. Clyde, and Wesley H. Blood.
Final Report to the Office of Saline Water, US Dept of the Int, Utah State Univ, Logan, Utah, July 1969. 127 p, 19 fig, 15 tab, 6 ref, 3 append. PRWG-61-2.

Descriptors: *Digital computers, *Optimization, *Simulation analysis, *Desalination plants, *Design, *Decision making, Reservoirs, Water resources, Hydrologic data, Hydrographs, Water demand.
Identifiers: Cachuma, Deer Creek, New York City.

The specific objectives of the research were: (1) to develop a digital computer program to conveniently determine the optimum operating rule for conjunctive operation of a desalting plant in order to help assess alternatives and to aid in decision making concerning plant design; (2) to apply the Operating Rule Program to three real-life situations where a desalting plant was operated in conjunction with a reservoir and water system; and (3) to assess the impact of conjection operation on the performance characteristics and the design of a desalting plant used in intermittent service and to identify the unique features of such plants. The Operating Rules Program received central focus and its general format was easily applicable to a wide variety of conditions. To find the optimum rule the historical hydrologic data for the reservoir and the water system were first analyzed. Long hypothetical streamflow sequences were then generated. Using the generated hydrographs along with the given reservoir characteristics and an assumed desalting plant capacity, the operation of the desalting plant was simulated by the computer program to test the ability of the various proposed rules to meet the needed water demand. The three real water systems studied were the Cachuma Project near Santa Barbara, California; the Deer Creek Project near Salt Lake City, Utah; and the NYC water supply system. Sensitivity of the optimum operating rule and the associated costs to changes in various input parameters were described. Additional useful research opportunities were suggested. (Kriss-Cornell)
W70-07865

3B. Water Yield Improvement

HYDRAULIC CONDUCTIVITY AND CERTAIN SOIL CHARACTERISTICS OF SUBSOILS WITH SPECIAL REFERENCE TO DRAINAGE DESIGN IN THE ALLUVIAL SOILS OF U.A.R.,
Ain Shams Univ., Cairo (Egypt). Dept. of Soils.
For primary bibliographic entry see Field 02G.
W70-07762

VEGETATION MANAGEMENT FOR WATER YIELD,
Forest Service, (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Marvin D. Hoover.
Symposium on Water Balance in North America, Banff, Alberta, Canada, June 23-26, 1967, p 191-195. Proceedings Series 7, Amer. Water Res. Ass'n, Urbana, Ill.

Descriptors: *Water yield improvement, *Vegetation effects, *Watershed management, *Water balance, *Snow management, *Snowmelt, Snowpacks, Timber harvest, Interception, Evapotranspiration, Weather modification, Clearcutting.
Identifiers: Multiple-use management, *Experimental watersheds, Forest patterns, Logging.

Kind, size, and arrangement of plant cover affect distribution of precipitation, snowmelt rates, soil water storage, evaporation and transpiration. These effects are of most significance to streamflow in forested areas where precipitation is comparatively abundant or concentrated into the cool season. These conditions are typical of the source areas for our rivers. Large-scale management of these lands for water may be possible because they are held in large blocks and much is publicly owned. Knowledge is sufficient to select areas of high potential for increased water yield. Yield increases tend to be greater during normally high runoff periods and in wet years. Economic value of such yield increases depends on water uses in the basin and on available storage. Large areas in the West approach ideal vegetation patterns and are now yielding near their potential. Where tree products are merchantable, water increase can be a valuable by-product of timber harvesting. However, where timber is of low wood value or high efficiency in water production desired, financing for water improvement must be found. Artificial augmentation of precipitation appears to offer promise for mountain areas which are often forest covered. Successful weather modification would increase the efficiency of vegetation management practices.
W70-07795

CHANGES IN WATER BALANCE COMPONENTS WITH PASTURE MANAGEMENT IN SOUTH-EASTERN AUSTRALIA,
Soil Conservation Authority, Kew (Australia).
F. X. Dunin.
Journal of Hydrology, Vol 10, No 1, p 90-102, January 1970. 13 p, 1 fig, 5 tab, 14 ref.

Descriptors: *Water balance, *Pasture management, *Rainfall-runoff relationships, Infiltration,

Evapotranspiration, Water yield, Water yield improvement, Carrying capacity.
Identifiers: *Australia.

A method for evaluating infiltration and evapotranspiration for experimental catchments was applied to a series of four-acre catchments near Bacchus Marsh, Victoria, Australia. Differences in runoff between two levels of native pasture production are the direct result of changes in infiltration. On the more productive pasture containing perennial grasses, the infiltration rate was higher because of a larger capacity for moisture storage in the topsoil, and higher rates of water movement in the subsoil. The conversion of both levels of native pasture to annual improved pasture was associated with a reduction in runoff in each case, due to increased evapotranspiration during periods when soil moisture conditions are assumed to be nonlimiting (topsoil moisture potential less than pF 3.5). The larger deficits developed in the soil moisture store led to increased infiltration and reduced runoff from rainfall events. The use of these findings to predict runoff, and their implications for catchment management, are discussed. (Knapp-USGS)
W70-07899

WEATHER MODIFICATION IN POPULATED AREAS,
EG and G, Inc., Bedford, Mass.
Wallace E. Howell.
In: Proceedings of the Fourth American Water Resources Conference (American Water Resources Association, Urbana, Illinois, 1968), ed. Phillip Cohen, Martha N. Francisco, p 613-622. 1 tab, 5 ref.

Descriptors: *Weather modification, *Cloud seeding, *Political aspects, *Attitudes, Droughts, Regulation, Education.
Identifiers: Weather Bureau, National Academy of Sciences, New York City, Mid-Potomac Valley, Fatalistic life outlook, Cooperative life outlook, Purposive life outlook, Familiarity.

Considerable speculation has been given to the social problems which could result from weather modification projects. In order to understand what attitudes have been expressed thus far, a fifteen case study has been compiled for all cloud seeding programs conducted between 1951 and 1965, is reviewed. All but two of these were conducted for the purpose of rain stimulation during a drought period. Of the two exceptions, one was purely experimental and the other was primarily for the purpose of hail mitigation with drought relief only a secondary objective. In all cases, with exception of the hail mitigation project, the public response was one of total indifference. It is suggested that the increased quantity of precipitation is not readily discernible. An average increase of twenty per cent is estimated from analyses to date; this was without causing an increase in the number of rainy days or producing any other recognizable abnormality in the weather. The hail mitigation project is discussed at length and opposition is described as having come from farmers who had not participated in the project and who believed that it had caused a drought. At present, no legislation curtailing weather modification has passed although a bill introduced by Representative Staggers could prohibit cloud seeding nationally. Lack of legal constraints in the public interest are suggested as producing mistrust; two social psychological studies investigating latent attitudes are also reviewed. Finally, the implications of weather modification are discussed for New York City and western New York state. (Davis-Chicago)
W70-07984

MODELS OF PRECIPITATING CUMULUS TOWERS,
Environmental Science Services Administration, Miami, Fla. Atmospheric Physics and Chemistry Lab.
Joanne Simpson, and Victor Wiggert
Monthly Weather Review, Vol 97, No 7, p 471-489, July 1969. 17 fig, 4 tab, 60 ref.

Descriptors: *Cloud seeding, *Artificial precipitation, *Hydrometers, Cloud physics, Buoyancy, Model studies, Radar, Supercooling, Silver iodide.
Identifiers: *Cumulus clouds, Maritime cloud, Autoconversion.

A model of the growth of cumulus clouds is presented. The water content and maximum height of rising towers are calculated using a buoyancy equation with consideration of effects of entrainment and water load. The latter is subject to effects of modeled microphysical effects. Precipitation growth is parameterized in terms of an autoconversion equation and a collection equation. A precipitation fallout scheme is devised that depends on water content, drop spectrum, and the vertical rise rate of the tower. Then 'freezing subroutines' are devised to model the effects of silver iodide seeding. A hierarchy of seeding routines, using different ice collection efficiencies and terminal velocities, is partially tested against the data of the Stormfury 1965 tropical cumulus-seeding experiment. Some preliminary numerical experiments on warm clouds are performed, assuming changes in drop spectra from hygroscopic seeding. (Osborne-Vanderbilt)
W70-08124

3C. Use of Water of Impaired Quality

RESEARCH ON THE UTILIZATION OF SALINE WATER FOR IRRIGATION IN TUNISIA,
Research Center for the Utilization of Saline Water for Irrigation (Tunisia).
J. M. de Forges.
Nature and Resources, Vol 6, No 1, p 2-6, March 1970. 3 tab.

Descriptors: *Saline water, *Water quality, *Irrigation water, *Irrigation effects, *Fertility, Arid lands, Semiarid climates, Irrigation, Irrigation practices, Brackish water, Land reclamation, Soil moisture, Soil properties, Soil structure, Drainage, Drainage effects, Crops, Crop production, Crop response, Rainfall, Leaching, Saline soils.
Identifiers: *Tunisia, *Irrigated agriculture.

The results of Tunisia's study of saline water use for irrigation purposes is reviewed by one of the program consultants. The major emphasis of the project lay in discovering whether soil fertility in semiarid areas could be maintained when the soil was irrigated by saline water. More specifically, the study was designed to determine the effect of brackish water on soils and decide what crops can be grown on soils irrigated by saline water. Although soil salinity did increase when land was irrigated with brackish water, it was always possible to reduce salinity with little difficulty. Salinity reduction was facilitated by the good natural or artificial drainage of all the lands under study. The project also showed that although soil salinity did reduce crop yield, it was not an insurmountable difficulty. Crops were affected by other factors common to semiarid zone irrigation, such as the adverse nature of soil structure and periods of plant fragility due to excess or insufficient soil moisture. While the results of this study may be applied to other irrigated areas, it should be remembered that naturally saline soils, alkalinity, and boron contamination were not matters of concern in Tunisia and therefore were not investigated. (Carr - Arizona)
W70-07773

SURFACE IRRIGATION WITH SALINE WATER ON A HEAVY CLAY SOIL IN THE MEDJERDA VALLEY, TUNISIA,
Institute for Land and Water Management Research, Wageningen (Netherlands); and Office de la Mise en Valeur de la Basse Vallee de la Medjerda, Tunis (Tunisia).
J. A. van't Leven, and M. A. Haddad.
Netherlands Journal of Agricultural Science, Vol 15, No 4, p 281-303, Nov 1967. 8 fig, 16 tab, 11 ref.

Descriptors: *Irrigation effects, *Surface irrigation, *Irrigation water, *Clays, *Saline water, Irrigation, Irrigated land, Land reclamation, Saline soils, Semiarid climates, Salinity, Water quality, Leaching, Groundwater, Water table, Water level fluctuations, Surface-groundwater relationships, Agronomic crops, Alfalfa, Soil types, Soil texture, Soil profiles, Salt balance, Drainage, Rotations, Crop response, Climatology, Discharge (Water).
Identifiers: *Tunisia, *Medjerda Valley, *Irrigated agriculture, Artichokes.

The Tunisian government, interested in reclaiming land and increasing food production in the Medjerda Valley, initiated a soil salinization study in 1962. The experiment looked at the salinization problem in terms of climatological factors, drainage, crop growth, crop rotation, saline soil, and saline water irrigation. Among the complications in attempting to farm the Medjerda area are heavy clay soils, shallow depth to saline groundwater, and the necessity of irrigating for 8-9 months of the year. The Medjerda Project is briefly described and a long list of results and conclusions of the experiment is given. (Carr-Arizona)
W70-07793

3D. Conservation in Domestic and Municipal Use

HOWELL V SEWICKLEY TOWNSHIP (SUIT TO ENJOIN OPERATION OF RESERVOIR AS TOWN WATER SUPPLY).

352 Pa 552, 43 A2d 121-127 (1945).

Descriptors: *Pennsylvania, *Reservoir operation, *Water utilization, *Municipal water, Reservoirs, Leases, Pumped storage, Reservoir storage, Water supply, Cities, Land tenure, Land use, Water rights, Land ownership, Legal aspects, Contracts, Judicial decisions, Land, Pumping, Pumps, Dams, Water storage, Remedies.

Plaintiff land owner sought a mandatory injunction against defendant township's proposed improvements of a pumping facility which was located on leased property. Plaintiff's contention, among others, was that the township's use of the water as a municipal supply constituted an unreasonable use and was a breach of conditions of the lease. The Supreme Court of Pennsylvania held that the use of the water from the reservoir as a municipal supply was not a breach of conditions of the lease and might at worst be held to be a breach of covenant. The trial court's judgment in favor of defendant was affirmed. (Barker-Florida)
W70-08021

CITY OF SYRACUSE V GIBBS (POWER OF THE STATE TO CONTROL ITS WATER RESOURCES).
283 NY 275, 28 NE2d 835-842 (1940).

Descriptors: *New York, *Water rates, *Water supply, *State jurisdiction, Water works, Judicial decisions, Legal aspects, Pipelines, Water allocation (Policy), Water conveyance, Water distribution (Applied), Water resources, Reasonable use, Administrative agencies, Administration, Legislation, Domestic water, State governments, Competing uses, Relative rights, Drainage, Usufructuary right, Utilities, Municipal water, Cities.

The State Water Power and Control Commission approved the village of Jordan's plans for the construction and operation of a municipal water system. The village was to draw its water supply from the city of Syracuse's lake source, utilizing Syracuse's water mains. Negotiation between Syracuse and the village failed to arrive at a service rate for the use of the mains. The village applied to

he Commission for a determination of the applicable rate. Dissatisfied with the Commission's determination, Syracuse appealed. The lower court reversed and the Commission appealed. Syracuse objected to the Commission's finding that its water supply could be appropriated by the state for other public uses. The court found exclusive dominion of the waters to be in the state. It is the state's duty to control its water resources for the benefit of all the state's inhabitants. The public right to the benefits of such resources was found to be an incident of sovereignty. The determination of the service rate was held to be a valid exercise of delegated authority to the Commission in protecting the interest of the state in its public waters. (Barnett-Florida)
W70-08055

CITY OF NEWARK V PASSAIC VALLEY WATER COMM'N (RELATIVE RIGHTS OF CITIES IN DISTRIBUTION OF RESERVOIR WATER).
192 A 835-836 (NJ Ch 1937).

Descriptors: *New Jersey, *Municipal water, *Reservoirs, *Water allocation (Policy), Water demand, Water consumption, Reservoir construction, Legal aspects, Judicial decisions, Regulation, Reservoir yield, Water distribution (Applied), Water management (Applied), Water supply, Relative rights, Impounded waters, Administrative agencies, Water rights, Adjudication procedure, Contract administration, Allotments, Coordination, Local governments.

Plaintiff municipality and defendant water commission, which represented another municipality, had together constructed a reservoir. Defendant sought to sell water from the reservoir to a third city pursuant to a contract with plaintiff providing that prior to the actual consumption by plaintiff and defendant cities of their respective allotments, either municipality was at liberty to authorize the commission to dispose of the allotments on their behalf to a third city. Plaintiff sought to enjoin the sale of water to the third city alleging the contract was void without its consent to a sale and that it was inequitable to allow the third city to obtain water at less than cost. Defendant moved to strike the bill in equity. The court held that the contract between plaintiff and defendant seemed to clearly indicate that neither municipality could prevent the sale of water by the other. However, the court refused to strike the bill stating that community water supply is a matter of great public concern and, pursuant to the court's power to regulate water use, it would consider other relevant facts in a hearing. (Hubener-Florida)
W70-08093

3F. Conservation in Agriculture

MEASURED AND ESTIMATED WATER USE BY A CITRUS AND AN APPLE ORCHARD,
Food and Agriculture Organization of the United Nations, Tal-Amara (Lebanon); and Lebanon Agricultural Research Inst., Tal-Amara. Dept. of Irrigation Engineering.
N. Vink, A. Aboukhaled, and S. Sarraf.
Magon, Serie Technique, Publication No 11, Jan 1970. 18 p, 4 fig, 5 tab, 19 ref.

Descriptors: *Water utilization, *Irrigation efficiency, *Orchards, *Citrus fruits, *Apples, Lemons, Oranges, Crop response, Irrigation effects, Timing, Irrigation practices, Irrigation, Consumptive use, Evapotranspiration, Soil-water-plant relationships, Moisture availability, Moisture stress, Moisture tension, Soil moisture, Moisture uptake, Soil water, Soil types, Saturation.
Identifiers: *Lebanon, *Water use efficiency, *Irrigation requirements.

Water utilization by mature apple and citrus orchards in Lebanon was studied for a 112-day period in June-September 1969. Measured evapotranspiration (ET) for citrus ranged between 3.3 and 4.9 mm/day and reached a total of 445 mm. Total ET was estimated by the Modified Blaney Criddle formula to be 451 mm. Net seasonal (April-November) irrigation requirement for citrus was between 650 and 700 mm, given in 11 to 13 irrigations. Since the orchards grew on heavy clay soil, slight water stress under 3-week irrigation intervals was preferable to saturation of deeper soil layers by more frequent and abundant irrigation. ET for apple trees ranged from 4.9 to 7.0 mm/day. Measured ET for 61 days (1968) and 92 summer days (1969) was 373 and 480 mm respectively. ET calculated for these same periods was 336 mm and 506 mm, resulting ina relatively high deviation between measured and estimated ET. Net seasonal (May-September) irrigation requirement for apples was approximately 680 mm, given in 7 or 8 irrigations. On the deep clay soils 85-90% of total moisture extraction was from the top 1.20 m of the soil profile for apple trees and from the top 0.60 m for citrus. (Carr-Arizona)
W70-07767

CONTROL OF SOIL MOISTURE DURING SPRINKLER IRRIGATION,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
Jack Keller.
American Society of Agricultural Engineers, 1968 Summer Meeting, Logan, Utah, June 18-21 1968, Paper No 68-243. 28 p, 8 fig, 2 tab, 19 ref.

Descriptors: *Irrigation effects, *Sprinkler irrigation, *Rates of application, *Soil moisture, *Analog models, Irrigation design, Irrigation practices, Aeration, Soil structure, Soil water, Moisture content, Soil profiles, Capillary conductivity, Saturation, Infiltration, Pores, Wetting, Equations, Bulk density, Irrigation, Crop production.

When soil moisture is controlled during irrigation it is possible to maintain better soil tilth and aeration. Under sprinkler irrigation regimes the moisture content of the wetted zone of the soil profile has been found to be a function of application rate. Since aeration and tilth affect crop yields, rate of application is an important design consideration for sprinkler irrigation systems. Using a pore-channel analog, the author developed an equation which related application rate to moisture content in the transmission zone of a deep soil profile. The equation is dependent on the soil but is independent of its bulk density. Laboratory experiments on various types of soil strongly supported the equation and its associated theory. (Carr - Arizona)
W70-07769

WATER STRESS AND APICAL MORPHOGENESIS IN BARLEY,
Adelaide Univ. (Australia). Waite Agricultural Research Inst.
For primary bibliographic entry see Field 02I.
W70-07770

RESEARCH ON THE UTILIZATION OF SALINE WATER FOR IRRIGATION IN TUNISIA,
Research Center for the Utilization of Saline Water for Irrigation (Tunisia).
For primary bibliographic entry see Field 03C.
W70-07773

MICROBIOLOGICAL PROBLEMS OF THE ARID ZONE,
Cornell Univ. Ithaca, N.Y. Lab. of Soil Microbiology.
M. Alexander.
Second International Conference on Global Impacts of Applied Microbiology, Interscience Publishers, No 1, p 285-291, 1969.

Descriptors: *Microbiology, *Arid lands, Diseases, Soil microorganisms, Aquatic microorganisms, Xerophytes.
Identifiers: *Applied microbiology.

The introduction of irrigation water to arid lands often creates unique problems directly or indirectly related to microbiology. Many of these have not been carefully studied. The author lists a number of areas and potential problems which would benefit from increased microbiological research: (1) Animal husbandry--problems involving nutrition and communicable diseases so that animal production per unit of land may be increased; (2) Rumen microbiology--including a survey of factors influencing rumen microflora; (3) Plant pathology--as total plant biomass increases in arid zones, indigenous pathogens become more important; (4) Groundwater recharge--particularly problems involving the production of polysaccharide plugs by bacteria; (5) Reclamation of saline soils; (6) Microbiological factors in improvement of soil structure; (7) Nitrogen production-root-nodule bacteria and symbiotic plants, and possible heterotrophic nonsymbiotic N fixation; (8) Biological control of insects. (Casey - Arizona)
W70-07779

USE OF SOIL, WATER AND LEAF ANALYSES IN GROWING ORANGES IN JORDAN,
Ministry of Agriculture Amman, (Jordan). Research Dept.
R. F. Allbrook.
Experimental Agriculture, Vol 3, No 3, p 215-222, July 1967. 6 tab, 12 ref.

Descriptors: *Oranges, *Soil-water-plant relationships, *Soil analysis, *Water analysis, *Irrigation water, Irrigation practices, Irrigation, Orchards, Leaves, Phosphorus, Potassium, Sodium, Chlorides, Nitrogen, Citrus fruits, Fruit crops, Standards, Arid lands, Semiarid climates, Water quality, Water types, Saline water, Salinity, Fertilizers, Fertilization, Nutrient requirements, Soil types, Saline soils.
Identifiers: *Leaf analysis, *Irrigated agriculture, *Jordan, Jordan Valley, Chlorosis.

Irrigated orange orchards in the Jordan Valley were sampled for soil, water, and leaf analyses. Most of the irrigation water was of good quality. However, use of water containing high sodium and chloride content increased the amount of these ions in the soil and caused such undesirable effects as leaf chlorosis. Soil analysis indicated that variations in soluble phosphorus and potassium ions were related to salinity of the irrigation water. Analysis of the leaves showed that chemical composition charged with age, but that the only significant difference among varieties was in potassium percentage. The author suggests standards of analysis for water, soil, and leaf composition that can be used when growing citrus. He also recommends that in order to keep soil salinity low, irrigation water class C3-S1 should not be used when annual precipitation is less than about 300 mm. (Carr - Arizona)
W70-07784

GENETIC VARIABILITY IN ROOT DEVELOPMENT IN RELATION TO DROUGHT TOLERANCE IN SPRING WHEATS,
Sydney Univ., Narrabri (Australia). North West Wheat Research Inst.
N. F. Derera, D. R. Marshall, and L. N. Balaam.
Experimental Agriculture, Vol 5, No 4, p 327-337, October 1969. 4 fig, 5 tab, 16 ref.

Descriptors: *Genetics, *Root development, *Drought tolerance, *Wheat, *Plant growth, Soil-water-plant relationships, Root systems, Plant breeding, Growth stages, Crop response, Drought resistance, Droughts, Moisture stress, Soil moisture, Water utilization, Evapotranspiration, Plant physiology, Plant morphology, Crop production, Grains (Crops), Cereal crops, Moisture deficit, Moisture availability, Arid lands, Semiarid climates.
Identifiers: *Australia, *Spring wheat, Water use efficiency, Jointing, Nodes.

Wheat production in northwestern New South Wales and southern Queensland is limited by the

general drought problem, but especially by the lack of predictable precipitation during the late-winter early-spring jointing and flowering period. Since the plants are dependent on sub-soil moisture accumulate during the summer fallow period, extent of root exploration for moisture reserves would appear to be a major determinant of drought tolerance. Fifteen varieties of Australian and exotic wheat were studied for genotypic differences in drought tolerance and patterns of root development. Early maturity appeared to be the most important characteristic of tolerant genotypes and accounted for 40 to 90 percent of observed variation in drought tolerance. There were, however, measurable relationships between water use efficiency, drought tolerance, and some root development parameters. Attributes which should receive more attention in breeding studies are length per unit weight of root, amount of nodal root development, and root activity between late jointing and maturity. (Carr - Arizona)
W70-07785

CARROT POPULATION DENSITY AND YIELD IN AN ARID ENVIRONMENT,
California Univ., Davis. Dept. of Water Science and Engineering.
Frank E. Robinson.
Agronomy Journal, Vol 61, No 4, p 499-500, July-August 1969. 2 fig, 3 tab, 3 ref.

Descriptors: *Carrots, *Density, *Sprinkler irrigation, *Crop production, *Arid lands, Arid climates, California, Root systems, Plant growth, Growth stages, Vegetable crops, Irrigation, Irrigation practices, Irrigation systems, Sprinkling, Size, Weight.
Identifiers: *Population density, *Dry matter, *Imperial Valley.

In an experiment in the Imperial Valley of California, population density of Daucus carota L. cultivar 'Long Imperator No 58' was studied under sprinkler irrigation. Seeds were placed on five square grid systems, with squares of 10.2, 5.1, 2.5, 1.3, and 0.6 cm on each side. These sizes corresponded with plant densities per ha of 870,000, 3,337,000, 13,590,000, 54,390,000, and 223,050,000, respectively. Of the five densities studied, carrots on the 10.2-cm square grid produced the earliest roots of marketable size, but the least dry matter. Twenty-five days later the plants on the 5.1-cm square grid produced greater yields in dry matter and roots of marketable size. The three highest plant densities yielded even greater amounts of dry matter but produced no roots of marketable size. There was a 2:1 root-to-top ratio for the three lowest plant densities and a 1:1 ratio for the two greatest densities. Under present market criteria and the arid conditions of the Imperial Valley, it does not appear advisable to plant carrots in densities greater than 3.3 million plants per ha. (Carr - Arizona)
W70-07787

WATER RELATIONS OF BEANS; II. EFFECTS OF DIFFERENTIAL IRRIGATION ON YIELD AND SEED SIZE OF BROAD BEANS,
Khartoum Univ. (Sudan). Dept. of Agronomy.
A. H. El Nadi.
Experimental Agriculture, Vol 6, No 2, p 107-111, April 1970. 1 fig, 4 tab, 7 ref.

Descriptors: *Beans, *Irrigation effects, *Irrigation efficiency, *Crop response, *Crop production, Seeds, Irrigation, Soil-water-plant relationships, Plant physiology, Water utilization, Water requirements, Timing, Size, Agronomic crops, Plant growth, Growth stages, Evaporation, Leaves, Economic efficiency, Drought, Moisture stress, Soil moisture, Flowering, Moisture content, Arid lands.
Identifiers: *Broad beans, *Sudan, *Irrigated agriculture, *Water-use efficiency, Pods, Potential evaporation.

A crop of broad beans was grown under four different irrigation regimes in an effort to determine the most economical irrigation policy. Plants were subjected to 'wet' or 'dry' irrigation treatments during two growth phases, resulting in wet/wet (WW), dry/wet (DW), wet/dry (WD), and dry/dry (DD) irrigation regimes. The WW treatment produced the highest yield per plot and resulted in the greatest water-use efficiency (as determined by weight of seeds per irrigation). It was also the most economically justifiable treatment, since the value of the increases seed yield was about five times the cost of the extra irrigation. The study revealed other information of interest to irrigators, such as the influence of growth stages on the effect of additional irrigation. (Carr - Arizona)
W70-07788

EFFECT OF PLANT DENSITY AND GROWTH DURATION ON GRAIN SORGHUM YIELD UNDER LIMITED WATER SUPPLY,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
A. Blum.
Agronomy Journal, Vol 62, No 3, p 333-336, May-June 1970. 5 fig, 1 tab, 13 ref.

Descriptors: *Sorghum, *Crop production, *Limiting factors, *Density, *Water supply, Environmental effects, Arid lands, Semiarid climates, Soil moisture, Soil water, Moisture stress, Vegetation effects, Plant populations, Plant growth, Growth stages, Mature growth stage, Growth rates, Time, Competition, Grains (Crops).
Identifiers: *Israel, *Water-use efficiency, *Plant density, Hybrid sorghum.

Hybrid grain sorghum grown entirely by stored soil moisture was studied in two experiments in Israel. In one experiment, sorghum hybrids were planted in 12 densities ranging from 2.9 to 27.9 plants per square meter and grown with 302 mm available soil water. Grain yield of an early maturing hybrid was highest under high plant density and yield of the late maturing hybrid was highest under low density. These relationships were also consistent regarding yield per plant, number of heads per plant, and number of grains per panicle. The highest yield for the entire experiment was from the earliest maturing hybrid planted at the densest population. Grain yield components were suppressed by increased competition and the early maturing hybrid at highest density attained its superiority by maintaining larger grain size in spite of increased interplant competition for water. A second experiment found that water use increased with increasing plant density. An early maturing hybrid used less water at all stages of growth than a later maturing hybrid. (Carr-Arizona)
W70-07789

SOME EFFECTS OF SOIL MOISTURE STRESS ON THE GROWTH OF WHEAT (TRITICUM AESTIVUM L. EM THELL.),
Arizona Agricultural Experiment Station, Tucson.
A. D. Day, and Suhbawatr Intalap.
Agronomy Journal, Vol 62, No 1, p 27-29, Jan-Feb 1970. 3 tab, 14 ref.

Descriptors: *Wheat, *Soil moisture, *Moisture stress, *Plant growth, *Crop response, Crop production, Seeds, Grains (Crops), Growth stages, Flowering, Arid lands, Arizona, Water requirements, Water utilization, Soil water, Irrigation, Irrigation effects, Environmental effects, Cereal crops, Particle size, Soil-water-plant relationships.
Identifiers: *Spring wheat, Jointing, Dough, Grain weight.

The effects of soil-moisture stress on growth and grain yield of spring wheat were studied in Arizona in 1966 and 1967. The wheat was planted in December and stressed at three different stages of development: jointing, flowering, and dough. The critical period for moisture was the jointing stage. Moisture stress at jointing resulted in earlier maturity, shorter plants, increased lodging, fewer seeds per head, fewer heads per unit area, lower grain volume-weight, and lower grain yield. Stress at any growth stage hastened maturity and decreased grain yield. However, when wheat was stressed at jointing grain yield reduction was due to fewer seeds per head and fewer heads per unit area, while lower yields in wheat stressed at flowering or dough resulted from lighter seed-weight. In order to achieve maximum grain yield, optimum irrigation must be provided throughout the entire growing season, not just during the critical jointing stage. (Carr-Arizona)
W70-07790

EFFECTS OF SEEDING RATE AND ROW SPACING ON ESTABLISHMENT AND YIELD OF CRESTED WHEATGRASS,
Agricultural Research Service, Fort Collins, Colo. Crops Research Div.; and Colorado Agricultural Experiment Station, Fort Collins.
William J. McGinnies.
Agronomy Journal, Vol 62, No 3, p 417-421, May-June 1970. 6 tab, 9 ref.

Descriptors: *Wheatgrasses, *Range grasses, *Planting management, *Crop production, *Soil moisture, Range management, Forage grasses, Forages, Grasses, Semiarid climates, Colorado, Proteins, Moisture availability, Moisture stress, Soil-water-plant relationships, Rainfall, Weeds.
Identifiers: *Crested wheatgrass, *Seeding rate, *Row spacing, *Stand establishment, *Herbage yield, Stand survival, Seedstalk height.

In range experiments on crested wheatgrass (Agropyron desertorum (Fisch. ex Link) Schult.) in northern Colorado, row spacing affected herbage yield, protein content, and seedstalk height and seeding rate influenced stand establishment and survival. Rows were seeded each spring in 1960, 1961, and 1962 at the rate of 33, 66, and 98 seeds/m. As seeding rate increased there was a corresponding increase in number of seedlings per m of row, but a decline in percentage of seeds producing seedlings. When the study ended in 1967 stand survival for the 98-seed rate was significantly better than for the 33-seed rate. Row spacings of 15, 30, 46, 61, and 76 cm were also studied. Herbage yield was highest for 30 and 46-cm spacings and lowest for 76-cm spacings, but yield varied widely among spacings due to age of stand, weather conditions, and year of seeding. As row spacing widened, seedstalk height increased. Although spacing showed no effect on protein content of the 1963 harvest, percent crude protein declined in 1964 when row spacing increased. All combinations of the 3 seeding rates and 5 row spacings were tested. (Carr-Arizona)
W70-07792

SURFACE IRRIGATION WITH SALINE WATER ON A HEAVY CLAY SOIL IN THE MEDJERDA VALLEY, TUNISIA,
Institute for Land and Water Management Research, Wageningen (Netherlands); and Office de la Mise en Valeur de la Basse Vallee de la Medjerda, Tunis (Tunisia).
For primary bibliographic entry see Field 03C.
W70-07793

SOME ASPECTS OF WATER MANAGEMENT FOR CROP PRODUCTION IN ARID AND SEMIARID ZONE OF INDIA,
Central Arid Zone Research Inst., Jodhpur (India).
A. Krishnan.
Annals of Arid Zone, Vol 8, No 1, p 1-17, Mar 1969. 1 fig, 9 tab, 20 ref.

Descriptors: *Arid lands, *Semiarid climates, *Evapotranspiration, *Moisture deficit, Irrigation programs, Climatic data, Droughts, Water loss, Consumptive use, Lysimeters, Precipitation, Agriculture, Crops, Root systems, Hydrologic budget.
Identifiers: *India, *Invisible drought, *Aridity index, Crop growing period.

In the most arid zones in India drought is permanent while in other arid and semiarid zones

there are seasonal rains. Agriculture is impossible in most areas without irrigation. The rainfall over these regions is erratic even within the rainy seasons and invisible drought may occur in which rainfall is inadequate to compensate for evapotranspirational losses. It is therefore necessary to gather adequate data to facilitate planning for suitable water management and crop planting. The arid and semi-arid zones of India are delimited in terms of land area, rainfall distribution, temperature patterns and the mean aridity index. The importance of potential and actual evapotranspiration studies is stressed and a network of lysimeters throughout the country is recommended. Estimates of moisture storage capacities of crop root zones in various soils are also needed. (Casey-Arizona)
W70-07797

SPRINKLER IRRIGATION--A BIBLIOGRAPHY SELECTED FROM FOREIGN LITERATURE,
Department of the Interior, Washington, D.C.
For primary bibliographic entry see Field 10.
W70-07879

HYDROLOGICAL IMPLICATIONS OF GRASS ROOTS STUDIES AT A SITE IN EAST AFRICA,
East African Agriculture and Forestry Research Organization, Nairobi (Kenya). Physics Div.
For primary bibliographic entry see Field 02I.
W70-07903

SIMULATION MODELING OF THERMAL EFFLUENT IN AN IRRIGATION SYSTEM,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
For primary bibliographic entry see Field 05G.
W70-08117

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MARR V HEMENNY (IMPOUNDED WATERS).

297 NW 504-505 (Mich 1941).

Descriptors: *Michigan, *Mill dams, *Flooding, *Impounded waters, Dams, Riparian rights, Dam construction, Judicial decisions, Legal aspects, Riparian waters, Riparian land, Flood damage, Dam design, Engineering structures, Ponds, Relative rights, Water utilization, Water law, Remedies, Prescriptive rights, Maintenance, Repairing, Water level fluctuations.

Defendants were the owners of a dam which impounded the waters of a creek. Plaintiff was the owner of riparian lands bordering on the mill pond above the dam. The wooden gates of defendants' dam became leaky and out of repair and insufficient to maintain any effective head of water. Twenty-five years later, the defendants installed steel gates in the dam which caused a rise in the pond water level and flooded part of plaintiff's lands. Prior to the dam reconstruction, plaintiff's lands had not been flooded and had been used for agricultural purposes. Plaintiff's judgment for damages and injunctive relief was affirmed by the Michigan Supreme Court. The court reasoned that the extent of a prescriptive right to cast water upon the land of another was measured by the lands actually flooded and not by the height of the dam. Consequently, defendants had no right, by means of repairs, making the dam capable of maintaining a larger head of water, to flood additional upper riparian lands. It did not matter that the dam height was not increased. (Powell-Florida)
W70-07673

EXIT GRADIENTS INTO SUBSURFACE DRAINS,
James N. Luthin, George S. Taylor, and Cesar Prieto.
Hilgardia, Vol 39, No 15, p 419-428, December 1968. 6 fig, 3 ref.

Descriptors: *Subsurface drainage, *Seepage, *Hydraulic gradient, *Drainage effects, *Soil texture, Soil density, Soil strength, Soil types, Cohesive soils, Cohesionless soils, Gravels, Sands, Sediments, Flotation, Void ratio.
Identifiers: *Quick condition, *Gravel envelopes, Kirkham's law, Soil particle weight, Surcharge load.

Water moving upward through a vertical gradient under the pressure of hydrodynamic seepage forces may cause the movement of sediments into a drain line if the soils in the vicinity of the drain line lack sufficient cohesiveness. This problem is minimal in the stable soils commonly found in the Midwest but may be quite significant in the relatively structureless soils of the western United States. The situation where by upward lifting forces create a weightless condition of the solid materials of the composite soil is known as the quick condition. In upward moving water the hydrodynamic seepage forces are opposed by gravitational forces, surcharge loads and soil cohesive forces. The resultant will determine whether a quick condition occurs. The hydraulic gradient where the seeping water emerges from the soil is called the exit gradient. A number of theoretical exit gradients into drain pipes under differing conditions of drain spacing, drain outer diameters, drain depths and drain barrier layers, were calculated using Kirkham's equation for hydraulic head potential and stream function. A flow net in the vicinity of a theoretical gravel envelope was also constructed. It was concluded that the use of a gravel envelope significantly decreases the exit gradient and therefore decreases sedimentation in the drain lines. (Casey - Arizona)
W70-07783

THE DETERMINATION OF THE DRAINAGE FACTOR AS A CRITERION FOR THE SOILS OF THE INDUS PLAINS,
International Land Development Consultants, Arnhem (Netherlands).
W. C. Hulsbos.
Netherlands Journal of Agricultural Science, Vol 16, No 1, p 25-35, Feb 1968. 5 tab, 6 ref.

Descriptors: *Drainage, *Drainage wells, *Soil texture, *Irrigation effects, *Design criteria, Irrigation, Groundwater, Recharge, Natural recharge, Water table, Water level, Aquifers, Discharge (Water), Salinity, Saline water, Evaporation, Consumptive use, Leaching, Seepage, Canals, Spatial distribution, Hydrology, Arid lands, Hydraulic conductivity.
Identifiers: *Pakistan, *Indus Plains, *Drainage factors, Irrigated agriculture, Horizontal drainage, Tubewell drainage, Leaching requirements.

In order for the cost of horizontal and tubewell drainage to be compared, drainage factors in the Indus Plains of West Pakistan had to be established for use as design criteria. The factors were calculated both from recharge estimates and from leaching requirements. The results of these two methods were compared and several types of drainage factors were distinguished. The researchers reached the following conclusions: (1) Recharge estimates yield higher drainage factors than leaching requirements. (2) Tubewell drainage will normally maintain a lower water table than horizontal drainage. (3) For tubewell drainage the factor derived from recharge estimates should be a criterion in establishing installed capacity. (4) In order to take account of seepage from line sources, a factor slightly higher than the one derived from leaching requirements should be used in calculating spacing of horizontal drainage. (5) If calculations result in wide drain spacings, the effect of intermittent recharge should be taken into account, especially in areas with any appreciable rainfall. (6) Accuracy required for drainage factors is limited and additional data collections should concentrate on hydraulic conductivity of the soil. (Carr-Arizona)
W70-07794

BRASKO V PRISLOVSKY (ACTION TO COMPEL THE REMOVAL OF A DAM PREVENTING DRAINAGE OF WATER FROM PLAINTIFF'S LAND).

183 SW2d 925-926 (Ark 1944).

Descriptors: *Arkansas, *Ditches, *Irrigation ditches, *Repulsion (Legal aspects), Surface irrigation, Channels, Drainage, Judicial decisions, Legal aspects, Surface drainage, Highways, Drainage systems, Drainage effects, Laterals, Surface waters, Water control, Riddance (Legal aspects), Culverts, Drains, Conduits, Surface runoff, Obstruction to flow, Relative rights, Flooding, Damages.

Plaintiff and defendant owned land on opposite sides of a highway running north and south, plaintiff on the west and defendant on the east. There were ditches on both sides of the highway, parallel therewith and designed to carry away excess surface water. Defendant's predecessor on the land had dug a ditch running eastward from the highway for irrigation purposes, and defendant dug another ditch running north and south along his west line, crossing the earlier east-west ditch at a right angle. This caused the obstruction of the east-west ditch. When obstructed water which previously had drained off plaintiff's land could no longer do so. Suit was brought to compel removal of the ditch which was causing the surface waters to back up on plaintiff's lands. The court held for the defendant, stating that a landowner may fend against the flow of surface water unless in so doing he unnecessarily or willfully damages another. There was no evidence that defendant had acted willfully, and he had every right to fend against the flow of waters over his land. (Barnett-Florida)
W70-07856

SIMULATION AND HYDROLOGIC RESPONSE OF A DRAINAGE NET OF A SMALL AGRICULTURAL DRAINAGE BASIN.
Uttar Pradesh Agricultural Univ., Naini Tal (India); and Illinois Univ, Urbana.
R. A. Rastogi, and B. A. Jones, Jr.
Transactions of the American Society of Agricultural Engineers, Vol 12, No 6, p 899-908, Nov-Dec 1969. 10 p, 22 fig, 7 tab, 14 ref.

Descriptors: *Drainage basins, *Watersheds (Basins), Simulation, Model studies, *Small watersheds, Streams, Streamflow, Overland flow, Routing, Surface runoff, Hydrology, Grid systems, Channel flow, Time lag, Slopes, Storm runoff, Inflow, Outflows, *Rainfall-runoff relationships, Mannings equation.
Identifiers: *Hydrologic models, Network analysis, Runoff hydrographs, Peak runoff.

An analysis was made of the morphologic relationships on 6 small upland drainage basins in Illinois. Regression lines were fitted to data, providing relationships of total number of streams and total stream length, highest stream order and total number of streams, length and number of different order streams, average channel slope and stream order, and channel bottom width and drainage area. These relationships were used to develop a model stream net for a 5-sq-mi basin with a drainage density of 14. The kinematic formulation for one-dimensional flow was used to route overland and channel flow through the drainage network of the basic third-order stream system of the model. The model was tested using different rainfall-excess durations and intensities to explore the linear and nonlinear relationships of the hydrologic process. (USBR)
W70-07869

CHANGES IN WATER BALANCE COMPONENTS WITH PASTURE MANAGEMENT IN SOUTH-EASTERN AUSTRALIA,
Soil Conservation Authority, Kew (Australia).
For primary bibliographic entry see Field 03B.
W70-07899

FENMODE V AETNA CASUALTY AND SURETY CO OF HARTFORD, CONN (SURFACE WATERS DEFINED).

6 NW2d 479-481 (Mich 1942).

Descriptors: *Michigan, *Surface waters, *Flood damage, *Excessive precipitation, Judicial decisions, Ice, Snow, Legal aspects, Damages, Thunderstorms, Watercourses (Legal), Percolation, Evaporation, Drains, Pipes, Tides, Sewers, Rain, Discharge (Water), Ducts, Air conditioning, Leakage.

Plaintiff was the owner of a women's apparel store. Defendant was plaintiff's insurer on a water damage policy. Plaintiff's stock was damaged by reason of a heavy rainfall while being stored in plaintiff's basement. Plantiff's policy did not cover losses due to floods, inundation, backing up of sewers or drains, influx of tides, or rising surface waters. The source of the water was the determining factor for recovery. Plaintiff claimed the damage was caused by water entering through a defective air duct, back door, and a partly opened window. Defendant claimed the damage was caused by surface waters flowing under a defective door. The court found the weight of evidence indicated that the damage was caused by surface waters, and affirmed the trial court's judgement for defendant. The court stated that surface waters are waters on the surface of the ground, usually created by ice or snow, which are of a casual or vagrant nature. They follow no definite course and have no permanent existence. (Leesfield-Florida)
W70-07900

FLOOD PLAIN INFORMATION, COASTAL FLOODING OF NORFOLK, VIRGINIA.
Corps of Engineers, Norfolk, Va.

U S Army Corps of Engineers Flood Plain Report, March 1970. 40 p, 8 fig, 7 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *Virginia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood, Hurricanes.
Identifiers: *Norfolk (Va), Standard project flood, Intermediate regional flood.

Flooding of the coastal areas of Norfolk, Virginia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-07909

MOUNTAIN BROOK ESTATES INC V SOLOMON (LIABILITY OF SUBDIVIDER, AS BETWEEN SUBDIVIDED LOTS SOLD, FOR DRAINAGE OVERFLOW).

23 So 2d 1-7 (Ala 1945).

Descriptors: *Alabama, *Community development, *Drainage, *Riddance (Legal aspects), Easements, Surface waters, Drainage systems, Drainage practices, Water control, Closed conduits, Control structures, Culverts, Outlets, Pipelines, Sewers, Cities, Legal aspects, Judicial decisions, Overflow, Land tenure, Real property, Relative rights, Ditches, Natural flow, Surface runoff.
Identifiers: *Servitudes.

Plaintiff servient estate owner sued the defendant corporation, the subdivider from whom he bought his property, for damages resulting from the overflow of a drainage ditch. The ditch serviced dominant estates and ran through an easement across the plaintiff's land. The lower court enjoined the defendant from allowing the overflow and required defendant to repair the drainage system. Plaintiff was also granted compensatory damages. The appellate court reversed, holding that the corporation's responsibility, to maintain the ditch it had constructed, passed to the grantees of the dominant estates at the time of such conveyances. The easement was appurtenant to and became a part of the dominant estates. Prior to said overflow, the subdivision had been incorporated into the city. The responsibility for the maintenance of the sewers then passed to the city. Moreover, the rules of law relating to the diversion of surface water were held inapplicable in that the defendant corporation, during such time as it was the owner of all the property in the subdivision, had a right to improve it, to destroy natural drains, and to provide other means for taking care of surface water thereon. (Price-Florida)
W70-07958

CITY OF PERU V CITY OF LA SALLE (RIGHT TO HAVE SURFACE WATERS NATURALLY DISCHARGED).

255 NE2d 502-507 (Ill Ct App 1970).

Descriptors: *Illinois, *Cities, *Drainage water, *Storm drains, Storm runoff, Prescriptive rights, Water rights, Surface runoff, Local governments, Legal aspects, Judicial decisions, Ravines, Natural streams, Watercourses (Legal), Drainage systems, Sewers, Outlets, Riddance (Legal aspects), Tile drains.

Plaintiff City of Peru sought an injunction to restrain defendant City of La Salle from draining water through a storm drain from the city limits of LaSalle into a ravine which ultimately drained onto property belonging to plaintiff. Plaintiff contended that in the absence of a natural watercourse draining the dominant land onto the servient land, defendant had no right to drain its land through the tile system onto plaintiff's land. Plaintiff also claimed a prescriptive right to be free from the drainage water since defendant's sewer system had drained water away from Peru for the past twenty years. The court denied the injunction stating that even in the absence of a natural watercourse, surface water may be drained into the same point of discharge where it would normally have found its way and the servient landowner cannot complain. The court also held that any prescriptive right that plaintiff asserted would be limited to the amount of water actually diverted by defendant and would not involve other surface water. Plaintiff failed to establish any such amount. (Hubener-Florida)
W70-07999

OLDENBORG V HYLEN (PROCEEDINGS FOR DRAINAGE SYSTEM TAKEN UNDER INAPPLICABLE STATUTE).
176 NW2d 78-81 (Minn 1970).

Descriptors: *Minnesota, *Drainage systems, *Legislation, *Local governments, State governments, Judicial decisions, Water law, Legal aspects, Ditches, Drainage programs, Administration, Water management (Applied), Drainage practices, Surface waters, Tiles, Drainage water, Surface runoff, Surface drainage, Assessments, Watercourses (Legal), Benefits, Real property.

Defendant county planned to improve a drainage area by constructing two ditches to drain lands previously drained only by a natural watercourse. The lands of the plaintiff, when drained only by the natural watercourse which flowed into an older drainage system had not been assessed for benefits. Plaintiffs contended that the upstream extension of the drainage ditches, into lands not previously assessed for benefits from construction of the existing drainage system, had been taken under proceedings prescribed by an inapplicable statute. The court held for plaintiffs stating that the county had proceeded under a statute which did not permit upstream extensions of such drainage ditches. The fact that the land to be benefited by the new project was not assessed for benefits in the original project required that the county follow procedures prescribed by another statute. (Hubener-Florida)
W70-08000

TIERNEY V EARL (ALTERATION OF FLOW OF SURFACE WATERS).
172 SE2d 558-561 (W Va 1970).

Descriptors: *West Virginia, *Grading, *Surface runoff, *Surface drainage, Water spreading, Overland flow, Soil erosion, Riddance (Legal aspects), Rain water, Flood damage, Land tenure, Landfills, Land use, Retaining walls, Land development, Land forming, Judicial decisions, Legal aspects, Relative rights, Alteration of flow, Obstruction to flow, Remedies, Damages.
Identifiers: Adjoining landowners.

Plaintiffs and defendant were adjoining home owners in a residential subdivision. One plaintiff alleged that the defendant, in grading his property, caused dirt to be piled on his side of the boundary line to a height of six to eight feet above the natural terrain. Defendant replied that excavations by the plaintiff in building his home had deprived defendant's property of lateral support and demanded relief. The other plaintiff, whose land also adjoined defendant's land, alleged that defendant had changed and raised the grade on another part of his lot so that the natural flow of surface waters on plaintiff's property was impeded. As a result, plaintiff suffered recurring flooding of his lot. The court held for both plaintiffs, and ruled that defendant was required to remove the dirt spilled on the first plaintiff's property. The court also ordered plaintiff to construct a retaining wall of sufficient height and strength to provide lateral support for defendant's property. Defendant was also ordered to remove the piled dirt which impeded the natural flow of surface waters from the other plaintiff's land. (Hubener-Florida)
W70-08001

ESCHETE V CITY OF NEW ORLEANS (FLOOD DAMAGES CAUSED BY INADEQUATE DRAINAGE SYSTEM).

231 So 2d 725-727 (La App 1970).

Descriptors: *Louisiana, *Cities, Drainage systems, *Storm runoff, Local governments, Storm drains, Urbanization, Utilities, Drainage water, Surface waters, Water control, Flood control, Precipitation (Atmospheric), Excessive precipitation, Rain, Storms, Flood damage, Damages, Judicial decisions, Adjudication procedure, Sewage systems, Construction.

Plaintiffs were homeowners in a subdivision area which, in times of heavy rainfall, experienced severe flooding due to defective and inadequate drainage systems. Plaintiffs alleged the city knew of the defects and failed to make improvements. Plaintiffs also alleged that, despite this knowledge, the city had authorized further construction of subdivisions in the area, thus greatly increasing the drainage problem. The court held the complaint insufficient since the city had no control over the drainage system and the flooding had occurred in the same area prior to authorization of further subdivision construction. The court pointed out that the co-defendant, the Sewerage and Water Board which controlled drainage systems, had the characterisitcs of a corporation, including the capacity to sue and be sued, and did not dismiss the suit against the Board. (Hubener-Florida)

W70-08002

BRADLEY V TEXACO, INC (DIVERSION OF SURFACE WATERS BY MEANS OF LANDFILL).
172 SE2d 87-90 (N C Ct App 1970).

Descriptors: *North Carolina, *Embankments, *Surface runoff, *Landfills, Land tenure, grading, Retaining walls, Slopes, Slope protection, Soils, Surface waters, Surface drainage, Riddance (Legal aspects), Judicial decisions, Legal aspects, Relative rights, Damages.

Plaintiff and defendant were adjoining landowners. Defendant oil company constructed a fill on its land to make it suitable for building a service station thereon. Plaintiff brought action for alleged damage to her property resulting from dirt, water and other debris washing down the embankment constructed by defendant. The lower court held for plaintiff. The appellate court acknowledged the principle that owners of land on a higher level cannot divert or interfere with the natural flow of surface water to the injury of servient owners without incurring liability. However, the court reversed and ordered a new trial since the lower court had refused to give permanent damages to plaintiff but had allowed testimony which constituted evidence of permanent damages in addition to testimony indicating amount of damages sustained by plaintiff up to the time of the trial. Since the evidence of permanent damage could have influenced the jury in assessing the amount of damage, the court ordered a new trial. (Hubener-Florida)
W70-08004

KEY SALES CO V SOUTH CAROLINA ELECTRIC AND GAS CO (DAMAGES CAUSED BY RELEASE OF WATER FROM DAM).
422 F2d 389-390 (4th Cir 1970).

Descriptors: *South Carolina, *Federal Power Act, *Dames, *Peak discharge, Hydroelectric plants, Damages, Water control, Water storage, Legislation, Electric power, Flood plains, Floods, Flood damage, Discharge (Water), Floodwater, Legal aspects, Judicial decisions, Relative rights, Water law, Riparian rights, Flooding, Flood protection, Land development, Excessive precipitation.

Plaintiff real estate developer sued defendant owner of hydroelectric dam when water released from the dam during a period of heavy rainfall caused damage to his lands. The court held for defendant ruling that plaintiff was not entitled to damages where the peak discharge of water from the dam did not exceed the peak flow of water into the dam during the storm. The court also found that the plaintiff developer's land lay in the flood plain of the river, had experienced flooding in previous years, and would have been flooded during the storm if the dam had not been in existence. The court also denied recovery for the damage under the Federal Power Act since the power company was not obligated by state law or federal license to operate its dam as a flood control facility for the benefit of lower riparian owners. (Hubener-Florida)
W70-08010

PETROVICH V UNITED STATES (SUIT FOR DAMAGES TO OYSTER BEDS ARISING FROM CHANNEL DREDGING).
421 F2d 1364-1370 (Ct Cl 1970).

Descriptors: *United States, *Louisiana, *Channels, *Dredging, Channel improvement, Excavation, Channel flow, Oysters, Commercial shellfish, Spoil banks, Damages, Silting, Silts, Sedimentation, Federal government, Remedies, Judicial decisions, Legal aspects, Erosion, Beds under water, Local governments, Engineering.

Plaintiff oyster growers brought action against the United States for damages to oyster beds caused by dredging of a channel. The dredging had taken place as a result of the Barataria Bay Waterway project authorized by Congress in 1958. Plans for the project, which included dredging by bucket dredge and construction of spoil banks, had been reviewed by state and local officials prior to commencement of the project, and the parish council and the state of Louisiana had executed assurances that the United States would be held harmless on liability claims for damages. As a result of the project, plaintiff's oyster beds suffered damage from increased silt accumulation. It was conceded that plaintiff was injured, so the measure of damages was the only remaining question. The United States Court of Claims applied a reasonable standard of damages on the ground that earlier oyster suits had shown actual damages impossible to determine. The collateral issue of the United States' attempted joinder of the local parish council was dismissed. (Barker-Florida)
W70-08013

THOMPSON V DYAR (CONSTRUCTION OF LEVEE ALONG CREEK CONTESTED BY LOWER RIPARIAN OWNER).
130 NE2d 52-54 (App Ct Ind 1955).

Descriptors: *Indiana, *Obstruction to flow, *Levees, *Natural flow, Natural watercourses, Riparian rights, Relative rights, Natural flow doctrine, Judicial decisions, Streambeds, Surface runoff, Streams, Dams, Damages, Floods, Proprietary power, Channels, Banks, Bank protection, Flooding, Repulsion (Legal aspects), Prescriptive rights, Remedies.
Identifiers: Injunctions (Mandatory).

Defendant constructed a levee extending one-quarter of a mile alongside a stream flowing through his property. Plaintiff, a lower riparian owner, sought an injunction requiring the defendant to remove the levee, alleging that it altered the natural course of the stream and caused an increase in the flow of water over plaintiff's lands. The circuit court entered judgment for defendant and the appellate court affirmed, stating that the levee had no effect on flowage of the creek water either in flood stage or low water stage. The court stated, as an analogy, that a lower proprietor may erect levees of reasonable height to prevent surface waters from entering his land, and he cannot be held liable for damages, if the obstruction causes water to flow on lands of another, unless the levee changes a natural or prescriptive course or channel. As there was no change in the course or amount of flow in the creek, the court refused to require removal of the levee. (Hubener-Florida)
W70-08020

TOWN OF HAMBURG V GERVASI (PRESCRIPTIVE EASEMENTS; SURFACE WATER).

55 NY S2d 876-878 (Sup Ct 1945).

Descriptors: *New York, *Prescriptive rights, *Surface drainage, *Easements, Natural flow doctrine, Adjudication procedure, Boundaries (Property), Community development, Drainage districts, Judicial decisions, Legal aspects, Land tenure, Local governments, Proprietary power, Public benefits, Repulsion (Legal aspects), Riddance (Legal aspects), Surface waters, Surface runoff, Relative rights, Remedies, Watercourses (Legal).
Identifiers: Injunctions.

Plaintiff city sought an injunction allowing it to enter defendant's land for the purpose of keeping open a watercourse and thus allowing for the free passage of drainage water. Plaintiff contended that from time immemorial surface waters had drained from upper lands across defendant's land, and the effect of such drainage had been to create a natural watercourse. In the alternative, plaintiff contended that it had acquired a prescriptive easement to drain surface waters across defendant's land. The court found the testimony insufficient to warrant the finding of a natural watercourse. Furthermore, the mere fact that surface water had always flowed from the land of the upper owner across defendant's land, without any other facts shown, would not give rise to a prescriptive easement. (Clarke-Florida)
W70-08022

FREIDEN V WESTERN BANK AND TRUST CO (SEWERS; PRESCRIPTIVE EASEMENTS).

50 NE2d 369-372 (Ohio Ct App 1943).

Descriptors: *Ohio, *Easements, *Sewers, *Prescriptive rights, Subsurface drains, Conduits, Legal aspects, Right-of-way, Drainage systems, Controlled drainage, Drainage water, Cities, Land tenure, Conveyance structures, Land use, Real property, Judicial decisions, Relative rights, Benefits, Beneficial use.
Identifiers: *Servitudes.

Plaintiff acquired a lot by deed of general warrantly from defendant bank. Plaintiff sued the bank and eight adjoining landowners to determine the status, rights, and duties of the parties with respect to a certain sewer, unmentioned in the deed, traversing all of said lots. All of the adjoining lots had at one time belonged to a common grantor who had constructed the sewer. The court found a sewer easement appurtenant to each lot and created by implication. The court held that implied grants of easement, although not favored, may be found on the basis of the following: (1) a severance of unity of ownership in an estate; (2) the use being shown to have been of a permanent nature before separation of ownership occurs; (3) the easement being reasonably necessary to beneficial engagement of the land granted; and (4) the servitude being continuous. The court further held that easements visible only on close inspection, such as underground drains, may pass by implied grant where the use is strictly necessary and the common owner intended the use to become appurtenant to the property benefited. (Hubener-Florida)
W70-08023

WILL V BOLER (OBSTRUCTION TO FLOW IN DRAINAGE DITCH CONSTRUCTED BY BOTH UPPER AND LOWER OWNERS).

4 NW2d 345-348 (Minn 1942).

Descriptors: *Minnesota, *Surface drainage, *Obstruction to flow, *Repulsion (Legal aspects), Runoff, Surface waters, Drainage, Surface runoff, Flow, Channels, Overflow, Land tenure, Ditches, Construction, Dams, Land, Maintenance, Damages, Benefits, Legal aspects, Judicial decisions, Landfill, Watercourses (Legal), Remedies, Relative rights.

Plaintiff upper landowner sought an injunction restraining defendant lower landowners from damming a ditch which aided the natural drainage of surface water from the area. The ditch had been constructed with contributions from predecessors in interest to the affected lands, including plaintiff's predecessor. Defendants filled part of the ditch, causing much of the surface runoff to overflow plaintiff's land. Plaintiff prevailed at the trial and defendants appealed on two grounds: (1) that evidence was insufficient to show a natural watercourse where the ditch ran; and (2) that evidence was insufficient to show plaintiff's predecessor contributed to the ditch's construction. The Minnesota supreme court affirmed the decision. The evidence supported both the finding that the ditch was constructed along a natural depression for surface drainage and that plaintiff's predecessor contributed to its construction. The Minnesota rule is that landowners may rid themselves of surface water but may not unreasonably or unnecessarily injure their neighbors in doing so. It is also the rule that where neighboring landowners unite to construct a drainage ditch to improve their holdings, each is estopped from closing the ditch in a way depriving others of the drainage. Defendants' acts

were unreasonable and injured plaintiff. A mandatory injunction restraining defendants was the proper remedy. (Duss-Florida)
W70-08024

LARSON V BUSSE (DRAINAGE SYSTEMS; EMINENT DOMAIN; COMPENSATION).
295 NW 47-53 (Minn 1940).

Descriptors: *Minnesota, *Eminent domain, *Drainage systems, *Local governments, Public benefits, Legal aspects, Judicial decisions, Surface waters, Riddance (Legal aspects), Streams, Tiles, Drains, Ditches, Outlets, Land tenure, Drainage effects, Compensation, Condemnation value, Riparian rights, Water law, Condemnation, Easements.
Identifiers: *Police power, Servitudes.

Defendant's land contained a slough which he wanted to drain in order to cultivate the ground. Defendant proceeded to construct a ditch to convey the water across the lands of the plaintiffs. The local township had authorized the construction under its drainage regulations and, by exercise of its eminent domain power, required subservient landowners (plaintiffs) to receive the drainage water. Plaintiffs sued for compensation. The court noted that under common law a landowner may direct surface waters onto adjoining lands as long as he does not cause unreasonable injury. However, under eminent domain powers, adversely affected landowners are entitled to compensation for all damages. The dissent stated that the township had exercised its police power in permitting the drainage, and benefiting the public thereby, and, therefore, no compensation was required. (Hubener-Florida)
W70-08030

GOODWIN V TEXAS CO (DUTY TO REMOVE CONTINUING NUISANCE).

185 A 695-696 (Me 1936).

Descriptors: *Maine, *Obstruction to flow, *Flood damage, *Abatement, Flooding, Damages, Watercourses (Legal), Flood control, Judicial decisions, Legal aspects, Remedies, Encroachment, Landfills, Regulation, Water injury, Construction.
Identifiers: *Nuisance (Continuing).

In former proceedings defendant corporation was found to have obstructed a natural watercourse in such a manner as to cause salt water and flooding damage to the lands and properties of plaintiffs. Plaintiffs were awarded damages as a result of such obstruction. However, the nuisance was not abated, and plaintiffs brought this action to recover further damages. Defendant maintained that plaintiffs' recovery in the prior suits represented the permanent damage and, therefore, this action could not be maintained. The court held successive suits could be brought for a nuisance where permanent damages cannot be ascertained. The general principle of law was stated that upon the creation of a nuisance, the creator may be legally compelled to remove it. For failing to so remove, defendant was found liable for damages resulting as of the date of filing suit in the prior suits up to the date of filing suit in the present action. (Finman-Florida)
W70-08032

WHEELER V TAYLOR (RIGHTS TO CONTINUED WATER FLOW).

39 A2d 190-193 (Vt 1944).

Descriptors: *Vermont, *Dams, *Easements, *Water use, Water supply, Water rights, Land use, Floodgates, Legal aspects, Judicial decisions, Mills, Saw mills, Mill dams, Riparian rights, Obstruction to flow, Alteration of flow, Relative rights, Remedies.

Defendant was the owner of a dam and flashboards on a pond upstream from plaintiff's saw mill. Plaintiff's grantor had owned both the mill and dam but had transferred only the former to plaintiff. The mill had burned down, and was inoperative at the time plaintiff purchased it. Defendant purchased the dam and surrounding land after plaintiff had rebuilt the mill and had resumed using the water as a source of power. Following a personal quarrel, defendant spiked the dam's flashboards in place and refused to allow the plaintiff access to the water. Plaintiff brought action to enjoin defendant's interference with this access. Plaintiff claimed that an implied easement had arisen from the deed of his grantor. The Supreme Court of Vermont pointed out that implied easements are created by reservation or grant and that only the latter might be applied to the instant case. The necessity of an easement was cited as an important but not determinitive factor. The court held that since the mill was inoperable at the time of plaintiff's grant, there was no need for the water and thus no grant of an easement to obtain it. The trial court's judgment for the defendant was affirmed. (Barker-Florida)
W70-08034

STROUGH V CONLEY (DIVERSION OF STREAMS--CONTRACT TO SUPPLY WATER).
164 Misc 248, 298 NYS 516-531 (Sp Ct 1937).

Descriptors: *New York, *Municipal water, *Supply contracts, *Water supply, Local governments, Water consumption, Water works, Water control, Utilities, Contracts, Legal aspects, Land tenure, Alteration of flow, Diversion, Riparian rights, Streamflow, Water utilization, Reservoirs, Water demand, Judicial decisions.

Plaintiff village had diverted streams into a reservoir for municipal use which previously flowed across the lands of defendants. The village agreed with defendants' predecessors in title to supply water to their premises. The supply to defendants was always inadequate and the village terminated the supply when it began to acquire its water from a nearby city. Plaintiff village brought this action to restrain defendants from interfering with the return of stream water to its original course and for a decree authorizing the plaintiff to abandon its objection and be relieved of any damages once the water was returned to its original course. In holding for defendants, the court ruled that the agreement with defendants' predecessors in title was a continuing obligation until defendants were restored to their original condition. Defendants held the same right as their predecessors and were entitled to damages for the previous inadequate service and for as long as the village diverted the stream water without supplying another source to defendants. However, damages for loss of revenue in defendant's dairy production were held to be based only on conjecture adn surmise and was not allowed. (Hubener-Florida)
W70-08037

CERA V CONSOL WATER POWER CO (FLOODING CAUSED BY RAISING OF DAM HEIGHT BEYOND AGREED LEVEL.
276 NW 124-126 (Wisc 1937).

Descriptors: *Wisconsin, *Dams, *Water levels, *Height, Flood damage, Overflow, Riparian rights, Damsites, Reservoirs, Dam construction, Barriers, Legal aspects, Judicial decision, Water law, Land use, Water storage, Water works, Utilities, Water sources, Relative rights, Contracts, Impoundments, Damages, Impounded waters.

Defendant maintained a dam across a river along which plaintiff owned land. Defendant and plaintiff reached an agreement by which defendant was allowed to flood a certain portion of plaintiff's land. Defendant subsequently raised the height of the dam 3 1/2 feet and plaintiff, in a suit for damages, contended that defendant had, by impounding more water, exceeded the extent of flooding permitted in the grant. The court, construing the agreement and a certain diagram recorded with it, found that the newly flooded land did not come within the original agreement and held for plaintiff. The plaintiff was entitled to damages equal to the difference in value of the land before and after the flooding caused by raising the dam. (Hubener-Florida)
W70-08039

KING V BROWN (DRAINAGE DITCH; PRESCRIPTIVE RIGHT).
298 Ky 485, 183 SW2d 490-492 (1944).

Descriptors: *Kentucky, *Ditches, *Easements, *Prescriptive rights, Drainage systems, Right-of-way, Legal aspects, Surface waters, Water control, Excavation, Trenches, Judicial decisions, Contracts, Benefits, Obstruction to flow, Remedies, Surface runoff, Runoff, Relative rights, Contracts, Real property, Excessive precipitation, Land tenure.

Plaintiff made a contract with an adjoining landowner authorizing construction of a ditch across the land of the adjoining owner. The ditch was constructed to carry off water which collected on plaintiff's lands and overflowed onto the adjoining land in times of heavy rainfall. Defendant, who purchased the adjoining land, filled in the ditch with rocks and debris and obstructed drainage flow, claiming that the ditch had not been constructed in accordance with the contract. Plaintiff sought an injunction ordering removal of the obstructions. The court held for the plaintiff stating that the existence and usage of the ditch for a period exceeding 10 years constituted compliance with the contract. Since defendant had been informed of the contract and the ditch before purchasing, he had knowledge of the easement right and could not complain of the insufficiency of the ditch. (Hubener-Florida)
W70-08040

HONEY V BERTIG (CASTING FLOOD WATER ON ADJACENT LANDS).
150 SW2d 214-216 (Ark 1941).

Descriptors: *Arkansas, *Drainage systems, *Overflow, *Relative rights, Ditches, Natural flow doctrine, Levees, Channels, Conduits, Structures, Conveyance structures, Controlled drainage, Judicial decisions, Legal aspects, Streams, Streamflow, Embankments, Alteration of flow, Drainage districts, Excessive precipitation, Floods, Floodwater, Damages.
Identifiers: Adjacent landowners, Scraper ditches.

Plaintiff and defendant were adjoining landowners in the same drainage district. A drainage ditch which tended to overflow in heavy rains, ran across their lands in a southeasterly direction. Plaintiff and defendant dug an additional scraper ditch to the south which ran across their lands and led into the drainage ditch. During floodwaters the drainage ditch overflowed into the scraper ditch. Defendant constructed a levee along the scraper ditch to prevent it from overflowing onto his lands to the south. Plaintiff sought an injunction for removal of the levee alleging that the levee cast the overflow waters onto his lands to the northwest. In holding for defendant the court acknowledged that a lower proprietor may not cast the waters of a natural stream upon lands of the upper proprietor to his injury. The court did not decide whether floodwaters constituted a natural stream or whether they were merely surface waters which could be thrown upon adjoining lands. However, the court did hold that the floodwater was a common enemy, and consequently defendant was entitled to protect his land unless, in doing so, he caused unnecessary injury to others. (Hubener-Florida)
W70-08042

JOHANNSEN V OTTO (DRAINAGE FLOW ACROSS ADJACENT LAND INCREASED BY

ARTIFICIAL DRAINAGE SYSTEM).

282 NW 334-336 (Iowa 1938).

Descriptors: *Iowa, *Drainage systems, *Surface drainage, *Natural flow, Drainage water, Drainage effects, Flood control, Overflow, Runoff, Surface waters, Surface runoff, Overland flow, Flow control, Water conveyance, Judicial decisions, Legal aspects, Water law, Tiles, Tile drainage, Construction, Relative rights, Damage, Routing.

Plaintiff owned a 100 acre tract of land on which, to expedite the natural flow of drainage water into a nearby creek, he constructed an artificial tile drainage system. Plaintiff sold 80 acres to defendant and retained a low-lying tract of 20 acres through which all the drainage water passed before entering the creek. Defendant permitted an adjoining landowner (second defendant) to construct a drainage system which tied into his own. Plaintiff sought damages and an injunction against the added flow, alleging that it caused his own system to overflow and damage the 20-acre tract. The court refused damages and the injunction on the basis of a state statute authorizing, as long as the system followed the natural course of drainage, construction of drainage systems to permit the collection and flow of water from one owner's land to another's. Here water flowing through the drainage system across plaintiff's land followed a natural course of flow. The court found the damage very slight, occurring only during heavy rainfall, and not attributable to the extra drainage. (Hubener-Florida)
W70-08043

WILLIS V PHILLIPS (SERVIENT ESTATE NOT ENTITLED TO HAVE CULVERT REMOVED TO PREVENT DRAINAGE ACROSS ITS LANDS).
5 So 2d 732-734 (Fla 1941).

Descriptors: *Florida, *Culverts, *Prescriptive rights, *Riddance (Legal aspects), Drainage water, Engineering structures, Overflow, Floods, Surface runoff, Drainage, Natural flow, Obstruction to flow, Remedies, Judicial decisions, Legal aspects, Ditches, Drainage effects, Routing, Flow control, Overland flow, Cities, Local governments, Roads.

Drainage water from a high area of land was collected in and flowed along a ditch paralleling a road. The water then flowed through a culvert maintained by defendant county commissioners and across lands of plaintiff into a pond. Plaintiff, alleging that the water flooded his land and damaged his crops, sought an injuction to require removal of the culvert. Plaintiff contended that for several years water had flowed in the ditch along the road without being directed across his land and that he had acquired a prescriptive right to have the water continue to flow only in the ditches along the road. The court, upon a finding that the natural course of flow was across plaintiff's land toward the pond, denied the request for the injunction. Drainage water cannot be prevented from following a natural course of flow. The court also found that the flooding on plaintiff's land was due to his attempts to obstruct the drainage flow, and that the flooding would be eliminated by construction of a ditch across his land. (Hubener-Florida)
W70-08044

LARE V YOUNG (DISCHARGE OF SURFACE WATER ONTO ADJOINING LAND).
53 Pa Super 28, 33 A2d 662-664 (1943).

Descriptors: *Pennsylvania, *Surface waters, *Surface drainage, *Surface runoff, Judicial decisions, Relative rights, Legal aspects, Natural flow doctrine, Easements, Natural flow, Cities, Runoff, Seepage, Obstruction to flow, Property values, Real property, Land tenure, Remedies, Reasonable use.

Plaintiff and defendant were owners of adjoining lots in a subdivision. Defendant's lot was of higher elevation than plaintiff's land. Plaintiff contended that the grading of defendant's lot and the construction of a driveway changed the natural contour of the lot and increased the normal volume of surface water flowing onto his property. Plaintiff sought an injunction and damages. In holding for defendant, the court stated that the owner of a lot in a city acquires land subject to the condition that existing surfaces are liable to be changed by the course of municipal development. An owner has a primary right to protect himself against the flow of surface water but may not collect and discharge surface water in a body and cause unnecessary injury. However, an owner may take reasonable measures to protect himself and incidental losses to neighbors are damnum absque injuria. The court found no evidence of a material diversion or increase of surface waters from defendant's property or any evidence of damage to plaintiff's property. (Hubener-Florida)
W70-08046

DARDENNE REALTY CO V ABEKEN (CONSTRUCTION OF DAM CONTESTED BY LOWER RIPARIAN OWNER).
106 SW2d 966-970 (St Louis Ct App Mo 1937).

Descriptors: *Missouri, *Diversion dams, *Natural streams, *Watercourses (Legal), Alteration of flow, Judicial decisions, Obstruction to flow, Diversion, Natural flow doctrine, Riparian rights, Relative rights, Dam construction, Flow control, Channel flow, Riparian land, Ditches, Rivers, Natural flow, Proprietary power, Lakes, Streams, Surface drainage, Prescriptive rights, Artificial watercourses, Impoundments.

Plaintiff was the owner of a large tract of land containing 2 lakes. The lakes were fed by a stream which also passed through defendants' land before entering plaintiff's land. The defendants constructed a dam across the stream to collect and divert the water into artificial lakes on their own land. Plaintiff sought an injunction against interference with the usual flow of water in the stream and for removal of the dam and closure of diversion ditches. Since the year of trial was particularly dry and there was little flow in the stream, it was necessary to determine whether the stream was a natural watercourse. The appellate court accepted the trial court's finding that, since the creek had a definite channel and its flow was not due only to surface drainage, the creek was a natural watercourse. The court also found that the action of a prior owner in raising one bank of the stream had not changed the stream into an artificial watercourse. Moreover, even if artificial, riparian rights could be acquired by prescription. The injunctions ordering removal of the dam and cessation of the diversions were affirmed. (Hubener-Florida)
W70-08047

TOWN OF BOONTON V STATE WATER POLICY COMM'N (REVIEW OF AGENCY DECISION CONCERNING DAM CONSTRUCTION).
122 NJL 34, 4 A2d 62-64 (1939).

Descriptors: *New Jersey, *Dams, *Reservoirs, *Administrative agencies, Permits, Administrative decisions, Cities, Public health, Water resources development, Structures, Damsites, Water storage, Water control, Water supply, Remedies, Judicial decisions, Legal aspects, Flooding, Water rights, Land use, Real property, Prescriptive rights, Swamps, Swimming, Flooding.

Plaintiff city sought review of defendant commission's decision granting a permit for a dam. The purpose of the dam, to be located on a stream which served as part of the municipal water supply, was to eliminate a swamp. Plaintiff alleged that creation of a reservoir in the designated location would endanger public health. It was also contended that defendant had improperly interfered with plaintiff's prescriptive right to flood the land of the party granted the permit. In dismissing the appeal, the Supreme Court of New Jersey pointed out the strict set of controls imposed by the commission to regulate the reservoir and foreclose the chance of pollution. Numbering eight in all, the conditions included swimming regulation, sewage safeguards, chlorination provisions, and various regulatory rights vested in the commission. The court held that the dam would ultimately result in a public benefit and that the commission's decision in no way effected property rights in the land where the reservoir would be situated. (Barker-Florida)
W70-08048

SMITH V ORBEN (INCREASED WATER FLOW IN STREAM).
182 A 153-156 (NJ Ch 1935).

Descriptors: *New Jersey, *Natural flow, *Drainage systems, *Relative rights, Riparian rights, Alteration of flow, Reasonable use, Water law, Flow, Streams, Upstream, Downstream, Drainage, Surface waters, Overflow, Drainage effects, Drainage engineering, Legal aspects, Remedies, Judicial decisions.

Plaintiffs, property owners, sought a mandatory injunction against defendant upstream property owner prohibiting the continued discharge of drain water into a stream which flowed through their properties. Defendant had developed his land so as to increase the accumulation of rain water and melted snow, and the discharge of these accumulations through a system of drainage so increased the flow of the stream that material damage was done to the properties of the downstream property owners. The court recognized the general rule that a property owner may collect surface water and discharge it into a natural water-course thereby increasing the volume and speed of the normal flow, but only to the point where the natural capacity of the stream is not exceeded so as to materially injure the lower reparian owner. It was held in the instant case that defendant had not acted within this general rule. The court did not issue the requested injunction, however, but rather instructed defendant that he should take immediate action to prevent further damage to plaintiff's property. (Barker-Florida)
W70-08052

COVELL V SIOUX CITY (EXCAVATION FOR CHANNELING OF STREAM AS AFFECTING LATERAL SUPPORT FOR ADJACENT LAND).
277 NW 447-451 (Iowa 1938).

Descriptors: *Iowa, *Percolating water, *Excavation, *Channeling, Groundwater, Groundwater movement, Reasonable use, Penetration, Underflow, Underseepage, Ditches, Streams, Land tenure, Land use, Real property, Water law, Judicial decisions, Legal aspects, Seepage, Banks, Embankments, Permeability, Structures.

Plaintiff and defendant were adjoining landowners. A natural stream ran through defendant's lot and defendant dug a new channel for it, excavating the ground to within several feet of plaintiff's lot. Plaintiff in a suit for damages claimed that the partial destruction of the lateral support for her property, due to the fact that water from the creek was enabled to percolate through the ground under her home, caused her house and sidewalks to settle and crack. The court stated that an adjoining landowner has the right to excavate up to boundary lines of adjoining territory, taking reasonable precautions to assure that adjoining soil does not fall from its own pressure. The excavating owner is liable if adjoining soil falls from its own pressure but is not liable if it falls due to the pressure of structures on the adjoining land. The court held that there was no evidence in support of the contention that water from the creek percolated under plaintiff's house. Therefore, the rule establishing the liability of a landowner who collects water and allows it to seep through the ground to the injury of adjoining landowner did not apply. (Hubener-Florida)
W70-08053

CARRABIS V BROOKLYN ASH REMOVAL CO (LIABILITY FOR DAMAGES RESULTING FROM SURFACE RUNOFF).
291 NYS 841 (App Div 1936).

Descriptors: *New York, *Surface runoff, *Relative rights, *Landfills, Storm runoff, Overland flow, Runoff, Environmental sanitation, Environmental engineering, Garbage dumps, Public health, Land forming, Sanitary engineering, Waste disposal, Land use, Flow, Surface waters, Surface drainage, Riddance (Legal aspects), Slopes, Rodents, Legal aspects, Judicial decisions.

Plaintiff and defendant were adjoining landowners. Defendant filled in lower land on his property with ashes and garbage so that his property was of greater height than plaintiff's land. As a result, water ran off defendant's property onto the premises of plaintiff in greatly increased quantities. Plaintiff brought this action for damages. In holding for defendant the court ruled that the filling-in operation was not an illegal act since it had not resulted in the creation of a defined watercourse or altered an existing one. Plaintiff was not entitled to damages for this particular cause although other nuisances created by defendant in the filling operation might warrant nominal or substantial damages. (Hubener-Florida)
W70-08054

TOWN OF BOONTON V FAY (TOWN SOUGHT TO HALT CONSTRUCTION OF DAM AND DEVELOPMENT OF ARTIFICIAL LAKE).
130 NJ Eq 55, 21 A2d 364-366 (1941).

Descriptors: *New Jersey, *Developed waters, *Land development, *Dams, Prescriptive rights, Reservoirs, Water pollution sources, Riparian rights, Public health, Public rights, Lakes, Impoundments, Watercourses (Legal), Potable water, Water quality control, Water utilization, Local governments, State governments, Permits, Administrative agencies, Regulation, Relative rights.
Identifiers: *Injunction (Prohibitory).

Plaintiff town sought to restrain defendant's construction of a dam. The purpose of the dam was to form a lake, following which defendant planned to develop the land around it. Plaintiff contended that: (1) the dam would create a source of pollution endangering the town's water supply; (2) the dam would diminish the flow of water into the town's reservoir; (3) the statute authorizing the permit was unconstitutional; (4) the dam would interfere with the prescriptive right of the town to overflow a portion of defendant's lands. The court, in determining whether a cause of action was stated, held that although potability of water was a primary consideration when the New Jersey Water Pollution Commission granted permits for dam construction, the issue of pollution had been decided in an earlier proceeding in favor of defendant. However, the issue of diminution of water supply had been previously heard and plaintiff could raise its common law right as a lower riparian owner. The constitutionality question had also not been raised previously and could be heard in the injunction proceeding. The alleged prescriptive rights of the town had not been raised in prior proceedings and the equity court had jurisdiction to consider those rights. (Hubener-Florida)
W70-08057

WHITCHER V STATE (RIGHT OF DAM OWNER TO CONTROL WATER LEVEL OF A POND).

181 A 549-556 (NH 1935).

Descriptors: *New Hampshire, *Impounded waters, *Riparian rights, *Mill dams, Ponds, Judicial decisions, Natural flow, Recreation, Reasonable use, Riparian land, Dam construction, High water mark, Water level fluctuations, Low water mark, Streamflow, Prescriptive rights, Water rights, Public benefits, Swimming, Fishing, Structures, Artificial use.

Defendants were owners of lots on the shore of a pond. Plaintiff owned a mill on the stream issuing from the pond. Plaintiff's predecessor in title had erected a dam on the pond and stream 70 years before, raising the water level of the pond 7 feet. Plaintiff reduced the water level of the pond in order to begin repairs on the dam, but defendants sought to restrain him. Plaintiff brought this action for determination of his rights. Defendants claimed that the plaintiff was only entitled to the natural flow over the dam and could not lower the water level by opening the gate in the dam. They also claimed a right by dedication to enjoy the artificial high water mark of the pond for swimming purposes. The court found that plaintiff had never intended to dedicate such a right and determined that plaintiff held a prescriptive right to use the flowage of the pond. The court further held that plaintiff was entitled to utilize the pond water down to the natural low water mark as long as the water was used as a source of power for his mill. However, the use could not be capricious or malicious with respect to interests in the pond of the riparian owners. Plaintiff could not be estopped from lowering the water level by the mere fact that cottages had been built around the pond during a period when the water was maintained at a high level. (Hubener-Florida)
W70-08062

TOWN OF PURCELLVILLE V POTTS (REASONABLE USE AND DIVERSION OF WATERS FROM A NATURAL STREAM).
19 SE2d 700-704 (Va 1942).

Descriptors: *Virginia, *Dams, *Alteration of flow, *Reasonable use, Obstruction of flow, Diversion, Judicial decisions, Legal aspects, Channels, Streams, Riparian rights, Riparian waters, Impoundments, Riparian land, Natural flow doctrine, Competing uses, Domestic water, Municipal water, Easements, Prescriptive rights, Relative rights, Discharge (Water), Diversion structures, Flow control, Eminent domain, Cities.

A spring-fed stream ran through plaintiff's land in a well-defined channel. Defendant city constructed dams on the stream above plaintiff's property, diverted the water from its natural channel and piped it into the city for the use of its inhabitants. Plaintiffs sought a mandatory injunction to abolish the dams and for damages for the diminution of the value of their property caused by defendant's actions. The court held that since both plaintiff and defendant were riparian owners, each had an equal right to the reasonable use of the water, but neither could diminish its quantity materially to the prejudice of lower proprietors. Defendant's diversion of the water beyond its riparian land was extraordinary and was not a reasonable use. Moreover, the use of the waters of a stream by a municipality is not a riparian right and a municipality can be held civilly liable for diverting waters and depriving lower riparian owners of the use thereof. However, the court here allowed the municipality to bring condemnation proceedings to obtain the riparian rights of plaintiffs to carry out their municipal purpose of obtaining a water supply for its inhabitants. (Barnett-Florida)
W70-08064

TACKETT V LINNENBRINK (RIGHT TO DIVERT SURFACE WATERS).
112 SW2d 160-164 (Ct App Mo 1938).

Descriptors: *Missouri, *Watercourses (Legal), *Diversion, *Repulsion (Legal aspects), Judicial decisions, Legal aspects, Natural streams, Alteration of flow, Diversion structures, Natural flow doctrine, Reasonable use, Relative rights, Riparian rights, Riddance (Legal aspects), Surface waters, Surface runoff, Drainage, Competing uses.

Plaintiff filed suit seeking damages for the alleged diversion of waters upon his land by defendant's negligent construction of a dam across an alleged watercourse that traversed their lands. Plaintiff contended there was a regular watercourse on his land with a definite channel having a bed and sides or banks. However, defendant argued that only surface waters that come upon this land passed across it and onto the adjoining land of plaintiff. From a trial court judgment for defendant, plaintiff appealed. The court stated that the general rule is that one may not divert or obstruct a watercourse so as to injure his neighbor's land. However, the court also stated that a dominant owner of land has a right to improve and protect his real estate by protecting it from surface water. Surface waters are a common enemy which every landowner may resist without liability. Since the question of whether or not certain water is surface water is a fact question for the jury, the court affirmed the trial courts judgment for defendant. (Barnett-Florida)
W70-08065

CLARK V PIERCE (RIGHT TO UNOBSTRUCTED NATURAL SURFACE DRAINAGE).
277 NW 711-712 (Iowa 1938).

Descriptors: *Iowa, *Surface drainage, *Surface runoff, *Obstruction to flow, Drainage systems, Drainage effects, Overflow, Runoff, Surface waters, Overland flow, Ditches, Routing, Flow control, Water conveyance, Natural flow, Artificial watercourses, Judicial decisions, Legal aspects, Alteration of flow.

Plaintiff and defendant were adjoining landowners. Plaintiff constructed a drainage system which directed surface waters across defendant's land. The system did not function effectively and plaintiff, without permission, entered defendant's land and dug a ditch to assist drainage flow. Defendant then placed railroad ties and fenceposts in the ditch. Plaintiff, in this action, sought an injunction to restrain defendant from interfering with the flow of water in the ditch. The court acknowledged that the owner of a dominant estate has the right to have surface waters accumulating on his land flow unobstructed in the natural course of drainage upon a servient estate. In holding for defendant, the court stated that the ditch was artificial and defendant was entitled to place the posts in it as long as he did not restrain the flow of water over his land more than it was impeded before the ditch was constructed. (Hubener-Florida)
W70-08069

DI NARDO V DO VIDIO (RIGHT OF DRAINAGE THROUGH ARTIFICIAL DITCH ON ANOTHER'S LAND).
45 NE2d 269-272 (Mass 1942).

Descriptors: *Massachusetts, *Ditches, *Obstruction to flow, *Natural flow, Spring waters, Alteration of flow, Relative rights, Springs, Discharge (Water), Streams, Judicial decisions, Legal aspects, Water law, Diversion, Flow control, Overflow, Drainage, Drainage practices, Watercourses (Legal), Prescriptive rights, Damages, Land tenure.
Identifiers: *Servitudes.

Plaintiff and defendant were adjoining landowners. Water from a spring on plaintiff's land flowed in a natural course through ditches running across the land of defendant and into a culvert. At an unknown time on defendant's land a newer ditch had been constructed which branched off the main course and carried water directly to the culvert, avoiding two right angle turns in the older course of flow. Water flowed through both branches before reaching the culvert. Defendant closed the newer ditch on his land causing water to rise on plaintiff's land since the old right-angled course did not provide sufficient drainage. Plaintiff sought damages and an injunction to open the newer ditch. The court refused to require the opening of the newer ditch, holding that the newer ditch did not constitute the normal course of flow of the water. A landowner cannot subject the land of another to a servitude of running water to which it is not naturally subject. The court also held that plaintiff had not acquired a right of drainage through the newer

ditch by adverse use. However, the court held plaintiff was entitled to have the older ditches cleaned and awarded plaintiff nominal damages. (Hubener-Florida)
W70-08075

STEED V KIMBROUGH (OVERTAXING OF LOWER OWNER'S DRAINAGE BY IMPROVEMENTS ON UPPER LANDS).
9 So 2d 925-927 (Miss 1944).

Descriptors: *Mississippi, *Surface runoff, *Repulsion (Legal aspects), *Riddance (Legal aspects), Surface waters, Flow augmentation, Alteration of flow, Diversion, Drainage, Drainage practices, Drainage systems, Flow control, Water control, Relative rights, Surface drainage, Rainfall - runoff relationships, Overland flow, Precipitation excess, Rain water, Ditches, Drainage effects, Natural flow, Judicial decisions, Legal aspects, Flooding.

Plaintiff and defendant were owners of adjoining land. Surface water naturally flowed from the defendant's unimproved upper land onto the plaintiff's lower land. The defendant constructed ditches through his upper lands and drained the surface water into a drainage ditch which the plaintiff had constructed along the common boundary. The accelerated flow and increased concentration of water overtaxed the plaintiff's ditch during heavy rains, and some water backed up onto the defendant's property. To force the plaintiff to improve his ditch, the defendant cut into the ditch and caused periodic flooding of the plaintiff's land. The plaintiff sought to enjoin the defendant, and the court held that the lower land owner, while ridding himself of naturally accumulated surface water, cannot use the upper land or cause water to back up in amounts greater than would be on the upper owner's property under natural conditions. However, neither can the upper owner create conditions, as was here done, which increase the flow onto the lower owner's land beyond that amount which would naturally flow thereon. If the upper owner creates such a situation, he must take care of the excess flowing back onto his property. (Price-Florida)
W70-08079

HALL V STATE (RIGHT TO DAMAGES FOR CASTING COLLECTED SURFACE WATER ONTO ADJOINING LAND).
33 NYS2d 1006-1007 (Ct Cl 1942).

Descriptors: *New York, *Surface runoff, *Riddance (Legal aspects), *Landfills, Drainage water, Concrete structures, Surface drainage, Rainwater, Earthworks, Land forming, Drains, Diversion structures, Diversion, Legal aspects, State governments, Land use, Alteration of flow, Real property, Damages, Relative rights, Impounded waters, Obstruction to flow, Remedies.

Plaintiff and the defendant state were adjoining landowners. Plaintiff placed fill upon a part of his land and also upon a part of the state's land. This fill caused the diversion of water after it left the end of a concrete gutter located on defendant's land. Without such fill water would have run from the gutter over state lands, passing plaintiff's property, and into a brook. Plaintiff sought damages for the diversion of water from the state lands to his property. The court acknowledged the rule that a landowner is entitled to recover where an adjoining owner collects surface waters and casts them upon his neighbor's property. However, the court held that here it was plaintiff's own action in placing the fill that caused the water to run from state land to plaintiff's land. (Hubener-Florida)
W70-08081

WRIGHT V CITY OF ONEONTA (MUNICIPAL LIABILITY FOR DAMAGES CAUSED BY OVERFLOWING STREAM).
165 Misc 492, 1 NYS2d 295-300 (Sup Ct 1937).

Descriptors: *New York, *Flood damage, *Excessive precipitation, *Alteration of flow, Local governments, Adjudication procedure, Judicial decisions, Legal aspects, Relative rights, Riparian land, Riparian rights, Riparian waters, Usufructuary right, Watercourses (Legal), Flood control, Dams, Flashfloods, Overflow, Cloudbursts, Rainfall, Floods, Intensity, Maximum probable flood, Diversion, Swimming pools.

A stream, to which the city had the water rights for the purpose of supplying the city residents, flowed through defendant city. During a particularly severe rainstorm, the stream overflowed its banks and the overflow damaged plaintiff's buildings and property. Plaintiff sued the city on the grounds that the city was obligated to maintain the stream within its banks and that, in altering the channel of the stream, defendant had failed to protect the rights of lower landowners. Evidence showed that defendant had for a short distance diverted the waters out of the natural channel in order to form a swimming pool. The water was then diverted back into the channel. The court held that a municipality through which a stream flows has no duty to keep it in a safe condition or free from obstruction not of its own causing, nor is it liable for damages from increased flow of surface water so long as the water is not diverted from its natural course. In this case the evidence did not warrant a finding that defendant had changed or increased the hazard from the stream in question. The conditions which caused the flood were unusual, extraordinary and unforeseeable. (Clarke-Florida)
W70-08083

WHITMAN V FORNEY (OBSTRUCTION OF DRAINAGE PIPE WHICH REPLACED DITCH).
31 A2d 630-634 (Md 1943).

Descriptors: *Maryland, *Pipes, *Easements, *Riddance (Legal aspects), Reasonable use, Highways, Administrative agencies, Drainage practices, Outlets, Subsurface drainage, Ditches, Drainage engineering, Open channels, Judicial decisions, Legal aspects, Repulsion (Legal aspects), Surface runoff, Clay pipes, Pipelines, Drainage water, Obstruction to flow, Prescriptive rights, Repairing, Roads, Relative rights, Natural flow.

Defendants blocked off a ditch carrying surface waters from a state road across their land. Plaintiff state road commission acquiesced in the filling of the ditch since a pipeline replaced the ditch as the means of drainage. The pipeline later broke and obstructed drainage from plaintiff's road. Plaintiff brought suit to enjoin defendants' obstruction to the drainage and to require defendants to restore the drainpipe to its original condition. The court held that the owner of upper land has a right to the uninterrupted flowage of water, and the proprietor of lower land, to which the water naturally descends, has no right to obstruct such flowage. The right to flowage exists without regard to a prescriptive easement. However, the court found that although plaintiffs were entitled to flowage over defendants' land, since plaintiff had acquiesced in the filling of the ditch with a pipeline, plaintiff was not entitled to compel defendants to maintain the line at their own expense. Plaintiff was entitled only to go upon defendants' land to repair the drain. (Barnett-Florida)
W70-08087

DARR V CAROLINA ALUMINUM CO (DAMAGE TO LAND AND CROPS RESULTING FROM OBSTRUCTION OF DRAINAGE FLOW).
3 SE2d 434-437 (NC 1939).

Descriptors: *North Carolina, *Drainage, *Watercourses (Legal), *Riddance (Legal aspects), Open channels, Judicial decisions, Legal aspects, Easements, Surface drainage, Ditches, Surface waters, Ponding, Dams, Channels, Prescriptive rights, Streams, Rivers, Banks, Trenches, Discharge (Water), Artificial watercourses, Surface runoff, Obstruction to flow, Silting.

Plaintiffs brought an action against defendant for the recovery of damages to land and crops. Plaintiffs alleged that defendant's negligent construction of a dam across the Yadkin River above plaintiffs' lands had caused the channel of the river to be filled with sand, debris and vegetation. This in turn caused its tributary streams that flowed over plaintiffs' lands to be obstructed. These obstructions allegedly prohibited the natural flow into the tributaries of drainage waters from a ditch on plaintiffs' lands. The court held that evidence failed to show that the obstructed ditch was a natural watercourse, defined as a ditch consisting of banks, beds and water while in a state of nature without artificial construction. Without such a showing plaintiffs did not have the legal right to collect the water on their land and discharge it through such ditch over the lands of defendant. The fact that plaintiffs had no other means of discharge did not give them such a right. Also, under the laws of North Carolina, the permissive use of the ditch for thirty years did not give plaintiffs an easement to continue such use. (Barnett-Florida)
W70-08090

LOUISVILLE AND NASHVILLE RR V CAPDEPON (DUTY TO REMOVE OBSTRUCTION TO NATURAL FLOW OF SURFACE WATERS).
4 So 2d 544-546 (Miss 1941).

Descriptors: *Mississippi, *Obstruction to flow, *Ditches, *Drainage, Construction, Damages, Surface waters, Slopes, Railroads, Drainage effects, Drainage engineering, Drainage patterns (Geologic), Drainage practices, Drainage systems, Drainage water, Legal aspects, Judicial decisions, Flow, Flow control, Flow resistance, Natural flow, Maintenance, Repairing.

Defendant railroad company constructed a railroad and a ditch adjacent to plaintiff's lot. The ditch was constructed to carry surface waters from plaintiff's lot since the railroad obstructed the natural flow of drainage. When the ditch was kept clear and free of debris, it would properly drain the water from plaintiff's land. However, the ditch became clogged by grass, tree tops and other debris. As a result, water backed up onto plaintiff's property. Defendant made no attempt to remove the obstructions. Plaintiff brought action for damages to his lot and the improvements thereon which resulted from this flooding. The court held that defendant not only had the duty to properly construct the ditch but also to properly maintain it so as not to obstruct the natural flow of surface waters from plaintiff's land. Consequently, defendant was liable for any damages incurred by plaintiff as a result of such obstruction. (Finman-Florida)
W70-08116

TOWN OF YORK V MCALPIN (DUTY TO DISCONTINUE WRONGFUL DIVERSION OF WATER).
2 Div 70, 167 So 539 (Ala 1936).

Descriptors: *Alabama, *Local governments, *Overflow, *Diversion structures, Surface drainage, Structures, Judicial decisions, Legal aspects, Remedies, Abatement, Flow control, Surface waters, Drainage systems, Damages, Watershed management, Regulation, Regulated flow, Standards, Design standards, Management, Culverts, Alteration of flow, Diversion.
Identifiers: *Nuisance, Injunction (Prohibitory).

Plaintiff private landowner brought action against defendant municipality for an injunction, damages, and the abatement of a nuisance caused by defendant's construction of pipes or culverts so that they caused surface waters to be wrongfully diverted and to overflow onto plaintiff's property. The court found that the manner in which the culverts were installed and maintained caused plaintiff's damages. Therefore, the court rendered judgement for plaintiff for the abatement of the nuisance and for damages. The injunction was granted as a necessary protection to plaintiff against the constant or frequently recurring injuries due to the

wrongful diversion of surface waters. The court found that damages alone could not provide an adequate remedy because of the nature of plaintiff's injury. (Clarke-Florida)
W70-08127

4B. Groundwater Management

GROUNDWATER CONTAMINATION,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 05B.
W70-07766

DOES ARTIFICIAL GROUND WATER RECHARGE CONTAMINATE OUR GROUND WATERS,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering; and Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
Marvin J. Dvoracek, and Rolland Z. Wheaton.
Agricultural Waste Management Conference, Cornell University, Typescript, January 1970. 19 p, 32 ref.

Descriptors: *Artificial recharge, *Groundwater, *Groundwater recharge, *Ecology, *Water pollution, Waste water disposal, Aquifers, Water supply, Water management (Applied), Water spreading, Pit recharge, Recharge wells, Balance of nature, Environment, Environmental effects.

The authors describe the methods of artificial groundwater recharge and raise the question of whether artificial recharge contaminates groundwater. They feel that no clearcut answer is available, but they hope to stimulate research and evaluation on planned and operational artificial recharge installations. In the past, severe groundwater contamination has generally been localized. However, the potential for widespread contamination is quite real and the authors fear it may already be occurring. Any damage may upset the total ecological system of the universe by the phenomena of biological amplification. Augmentation of the water supply by artificial recharge should not be considered so important as to openly invite the use of contaminated recharge water. (Carr - Arizona)
W70-07771

THE DETERMINATION OF THE DRAINAGE FACTOR AS A CRITERION FOR THE SOILS OF THE INDUS PLAINS,
International Land Development Consultants, Arnhem (Netherlands).
For primary bibliographic entry see Field 04A.
W70-07794

ANTICIPATIONS OF CHANGE: A SOCIO-ECONOMIC DESCRIPTION OF A KENTUCKY COUNTY BEFORE RESERVOIR CONSTRUCTION,
Kentucky Water Resources Inst., Lexington.
For primary bibliographic entry see Field 06B.
W70-07994

VANDERBILT V STATE (DESTRUCTION OF WELL'S WATER SUPPLY).

159 Misc 586, 288 NYS 544-545 (Ct Cl 1936).

Descriptors: *New York, *Subsurface waters, *Road construction, *Water wells, Wells, Underground streams, Underground, Groundwater, Relative rights, Springs, Subsurface investigations, Excavation, Civil engineering, Construction, Soil mechanics, Highways, Highway effects, Judicial decisions, Legal aspects.

Defendant state, in the construction of a highway, cut through a subterranean stream and rendered useless the well of plaintiff who owned land adjacent to the construction site. Plaintiff sought compensation for the taking of private property and damages. The court found that the highway was constructed in conformity with usual plans, specifications, and accepted engineering methods and the state had had no knowledge of the existence of the subterranean stream. The court held that since no property of plaintiff had been taken, he was not entitled to any damages in the absence of negligence or knowledge of the stream's existence. (Hubener-Florida)
W70-08027

4C. Effects on Water of Man's Non-Water Activities

EFFECT OF URBANIZATION ON STORM WATER PEAK FLOWS,
Pedro C. C. Da Costa.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA 2, Paper 7198, p 187-193, April 1970. 7 p, 1 fig, 3 ref, append.

Descriptors: *Rainfall-runoff relationships, *Urbanization, *Storm runoff, *Peak discharge, Hydrograph analysis, Rational formula, Drainage, Precipitation intensity, Watersheds (Basins), Frequency analysis, Storm drains, Time of concentration.
Identifiers: Urban watersheds.

Urbanization of a natural watershed modifies the original shape and proportions of the hydrograph that may be considered representative of the natural watershed. The unique runoff coefficient of the rational formula is, in fact, the product of three factors, each one having some correlation with the degree of urbanization given to the watershed. The influence of urbanization is mainly expressed by the degree of imperviousness and the degree of artificial canalization given to the watershed. The presented general rational formula is related to other rainfall-runoff relationships derived by Snyder and by Horner-Flynt. Results from the formula are compared with these obtainable by the Chicago Method. The concepts presented must be considered as one way of demonstrating the relationship between rainfall and runoff in areas which are urbanized or not, rather than a completely developed and tested method of calculating storm water peak flows. (Knapp-USGS)
W70-07671

A HYDROMETEOROLOGICAL STUDY RELATED TO THE DISTRIBUTION OF PRECIPITATION AND RUNOFF OVER SMALL DRAINAGE BASINS - URBAN VERSUS RURAL AREAS,
Texas A and M Univ., College Station. Water Resources Inst.
Robert G. Feddes, Robert A. Clark, and R. C. Runnels.
Available from the Clearinghouse as PB-192 635, $3.00 in paper copy, $0.65 in microfiche. Technical Report No. 28, June 1970. 64 p, 5 tab, 27 fig, 20 ref. OWRR Project A-010-TEX (1).

Descriptors: *Rainfall-runoff relationships, Surface runoff, Rainfall, *Urbanization, Precipitation (Atmospheric), Texas, *Streamflow, *Watersheds (Basins), Hydrograph analysis, Meteorology.
Identifiers: Bryan (Tex).

The effects of urbanization on streamflow are investigated for two adjacent similar watersheds located in and near Bryan, Texas. The Burton Creek watershed is 84 per cent urbanized and the Hudson Creek watershed is completely rural. Storms observed within each basin are used for comparison of pertinent hydrograph parameters. Simultaneous events are compared between the watersheds and the urbanization effect noted. A synthetic procedure for predicting hydrographs on both watersheds is developed. Reproduction of actual events indicates better results in the rural watershed. There is conclusive evidence that the urbanization of a watershed decreases time-to-peak and increases the peak discharge.
W70-07980

SIMPLIFICATION OF INTEGRATED STORM-WATER PLANNING FOR MODERN, MULTIPLE LAND USE IN URBAN AND SUBURBAN DEVELOPMENTS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
B. M. Reich.
Available from the Clearinghouse as PB-192 750, $3.00 in paper copy, $0.65 in microfiche. Project Completion Report, March 31, 1970. 11 p, 8 tab, 30 fig, 40 ref, 2 append. OWRR Project B-010-PA (1).

Descriptors: *Storm runoff, *Flood routing, *Flood control, *Synthetic hydrology, *Urbanization, *Planning, Design flood, Headwaters, Computer programs, Floodways, Reservoir operation, Grassed waterways, Water management (Applied), Watershed protect, Flood prevent.
Identifiers: Return period, *Urban hydrology, Downstream hydrograph, Grassed valley bottoms, Blue and green concept.

Four synthetic hydrograph methods were applied on five watersheds in hopes of simplifying planning decisions for reserved space in valley bottoms of suburbia headwaters. Both hydrograph and routing procedures were programmed for digital computer evaluation for the more than 300 cases considered. General conclusions include the following. (1) No simple rules can be given on width of floodways to planners. Each case must be individually investigated. (2) Computer methods greatly facilitate routing and synthetic hydrograph computations. (3) Generalizations are impossible because interactions occur between the method used, the return period, and the percentage of the watershed above the reservoir among others. (4) A great need exists for data-based methods for predicting suburban design hydrographs in ungaged situations. (5) A new course on urban hydrology was developed from the studies results. The course is designed to teach hydrologists the modern techniques which are being developed to solve this set of urban problems. (Sink-Penn State Univ)
W70-07981

REPUBLIC STEEL CORP V STRACNER (DAMAGE TO WELLS CAUSED BY MINING OPERATIONS).

21 So 2d 690-693 (Ala 1945).

Descriptors: *Alabama, *Mining, *Overlying proprietor, *Damages, Adjudication procedure, Boundaries (Property), Judicial decisions, Land tenure, Leases, Legal aspects, Proprietary power, Relative rights, Groundwater, Remedies, Drainage effects, Wells.
Identifiers: *Mineral rights.

Defendant corporation owned mineral rights to land adjoining and under plaintiff's property. Evidence indicated that defendant had operated mines under plaintiff's property and that, in retreating from such mines, defendant had removed pillars supporting the roof of the mines. As a result, the land superjacent to the mine shafts caved in, causing a nearby percolating well on plaintiff's land to dry up. Plaintiff sued for loss of property value. The court held that miners are strictly liable for damages caused by disturbances of land from mining operations. A miner, however, is not liable for incidental damages necessarily occasioned by ordinary and careful operation of a mine, and not injurious to the surface, such as the loss of wells by the superjacent owner. But if such wells are willfully or negligently drained without reasonable need to do so, causing damage to the surface owner, there is a cause of action. The court held that defendant's failure to properly support the abandoned mine shafts constituted such a cause of action, and affirmed the trial court's judgement for plaintiff. (Clark-Florida)

W70-07982

VANDERBILT V STATE (DESTRUCTION OF WELL'S WATER SUPPLY).
For primary bibliographic entry see Field 04B.
W70-08027

THE CLIMATE OF CITIES,
For primary bibliographic entry see Field 02B.
W70-08121

RECENT STUDIES OF URBAN EFFECTS ON PRECIPITATION IN THE UNITED STATES,
Illinois State Water Survey, Urbana.
Stanley A. Changnon, Jr.
American Meteorological Society Bulletin, Vol. 50, No. 6, p 411-421, June 1969. 2 fig, 4 tab, 39 ref.

Descriptors: *Precipitation (Atmospheric), *Cities, *Climatology, Thunderstorms, Hail, Thermal pollution, Rain gages, Frequency, Snowfall, Condensation, Orography.
Identifiers: *Urban-induced nuclei.

Very little research has been conducted dealing with urban effects on precipitation. However, the few studies which have been conducted reveal from 5 to 16% increases in precipitation and from 7 to 30% increases in summer thunderstorm days in urban areas. Even greater increases in precipitation have been observed downwind from major steel mill complexes. These changes have been credited to urban-induced nuclei concentrations and urban thermal effects. The results of the urban studies may indicate the effectiveness of ground-based seeding, the possibility of successful increases in all seasons, the likelihood of thunderstorm and hailstorm increases with rainfall increases, and the need for dense raingage networks to adequately determine the area and amount of increase. (Osborne-Vanderbilt)
W70-08126

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

RESEARCH NEEDS ON THERMAL AND SEDIMENTARY POLLUTION IN TIDAL WATERS,
V. D. Masch.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7426, p 1539-1548, July 1970. 10 p, 7 ref.

Descriptors: *Tidal waters, *Estuaries, *Water pollution effects, *Water pollution sources, *Research facilities, Water temperature, Water pollution, Tidal effects, Sediments, Hydraulics.
Identifiers: *Research needs, *Estuarine pollution, Tidewater.

When requested to identify the most pressing research need in its field, the ASCE Tidal Hydraulics Committee quickly arrived at the consensus opinion that thermal and sedimentary pollution of tidal water bodies was the major problem. Over a period of a year valuable ideas and suggestions have been obtained from all committee members. Sedimentary and thermal pollution problems in tidal water are described and the literature and some related research are reviewed. General and specific research needs in both thermal and sedimentary pollution, as well as instrumentation, are outlined. (Knapp-USGS)
W70-07656

FALLOUT AND CLIMATE STUDIES ON FIRN CORES FROM CARREFOUR, GREENLAND,
Innsbruck Univ. (Austria); and Copenhagen Univ. (Denmark). H. C. Orsted Inst.
W. Ambach, and W. Dansgaard.
Earth and Planetary Science Letters, Vol 8, No 4, p 311-316, May 1970. 6 p, 3 fig, 1 tab, 16 ref.

Descriptors: *Fallout, *Glaciers, *Tracers, *Tritium, *Profiles, Climatology, Tracking techniques, Regimen, Arctic, Stable isotopes, Radioisotopes.
Identifiers: Greenland, Oxygen isotopes.

To compare detailed, vertical gross beta-activity and tritium profiles in a high polar glacier with a temporal record of fallout of fission products at high latitudes, to compare the annual net accumulation data that might be derived from the radioactivity and stable isotope profiles, and to estimate the recent climatic development on the mid-Greenland ice sheet, two snow and firn cores, 20 meters apart, were hand augered at Station Carrefour on the Greenland ice sheet. Only little summer melting and no runoff occur in the area. Both of the ice cores were cut into 10-15 cm long increments. The longer core, representing the upper 20 m, was analyzed for gross beta-activity and oxygen isotope ratios; the short core, reaching from 1 to 10 m below surface, was analyzed for tritium and oxygen isotopes. None of the beta-activity and O-18 profiles is quite sufficient for establishing a reliable isotopic identification of recent annual snow layers at Carrefour. However, such identification can be obtained in the period 1953-65 by comparing the two profiles mentioned, or by comparing the beta-activity profile with exactly dated fall-out data from nearby stations. The use of the beta-activity measurements is limited to strata formed since 1953. (Knapp-USGS)
W70-07667

TECHNOLOGY AND ECONOMICS OF SEWAGE TREATMENT (IN GERMAN),
M. Kehren.
CIBA-Runschau, No 130, p 2-34, 1957.

Descriptors: *Self-purification, *Iron, Economics, Waste water treatment, *Sewage treatment, Sewage, Sewage effluents.
Identifiers: *Chemical composition, *Textile mill wastes, Sewage condition, Iron salts, Dyeing wastes, Plant design, Niers process, Pista process.

A series of short illustrated articles deals with regard to the condition of sewage and waste waters discharged to streams; processes of self-purification and the organisms concerned; amount and chemical composition of waste waters from textile, leather, and paper works; processes and plant for the treatment of waste waters; the use of iron and iron salts in the treatment of waste waters containing dyestuffs; the design of modern plants for the treatment of very polluted waste waters by the Niers process and the Pista process; and plant and operation costs. (Livengood-North Carolina State)
W70-07730

API RECOMMENDED PRACTICE FOR ANALYSIS OF OIL-FIELD WATERS.
American Petroleum Inst., Dallas, Tex. Div of Production.
For primary bibliographic entry see Field 02K.
W70-07908

SWAP CHEMICALS FOR CLEANER STREAMS,
Wesleyan Univ., Middletown, Conn.
For primary bibliographic entry see Field 05B.
W70-07972

APPLICATIONS OF FLUORESCENT TRACER TECHNIQUES IN POLLUTION CONTROL STUDIES,
Beak (T.W.) Consultants Ltd., Montreal (Quebec).
For primary bibliographic entry see Field 05G.
W70-08100

DETERMINATION OF NITRATE IN WATERS WITH THE NITRATE-SELECTIVE ION ELECTRODE,
Wisconsin Univ., Madison. Dept. of Soils.
For primary bibliographic entry see Field 07B.
W70-08105

WOOL INDUSTRY WASTE WATERS (IN RUSSIAN),
For primary bibliographic entry see Field 05D.
W70-08140

5B. Sources of Pollution

GOOD HOUSEKEEPING IS BEST SOLUTION TO STREAM POLLUTION,
Massachusetts Inst. of Tech., Cambridge.
R. E. McKinney.
American Textile Reporter, Vol 71, p 71-74, 1957.

Descriptors: *Water pollution, *Waste waters, *Pollution sources, *Water pollution effect, Waste waters, Water conservation, Test procedures, Inorganic waste.
Identifiers: *Process chemicals, *Effluent treatment, Waste water analysis, Absorption capacity (Stream).

The textile industry contributes to three basic types of pollution: (1) materials having a high oxygen demand, (2) inorganic matter, and (3) color. The major textile waste problem results from the organic fractions in their process wastes. Greater emphasis is needed on water conservation and water pollution; the textile industry must become concerned with these problems. Although few mills have the properly trained personnel and/or proper equipment, if plant managers will consider carefully the following 10 specific areas, water can be more readily conserved and pollution can be better controlled: (1) The pollution absorption capacity of the stream. (2) Sources of pollution within mill. (3) Volume of water used and pollutional characteristics. (4) Good housekeeping reduces pollution to minimum. (5) Process changes or process chemical changes. (6) Waste treatment is last resort. (7) Chemical treatment for colloidal or suspended pollution. (8) Biological treatment for soluble wastes. (9) Evaluation of each type of treatment. (10) Separate treatment verses combined treatment. The proper consideration of each of these steps will result in the most economic solution to textile mill waste treatment problems. (Robinson-North Carolina State)
W70-07756

GROUNDWATER CONTAMINATION,
Guelph Univ. (Ontario). Dept. of Soil Science.
Robert W. Gillham, and L. R. Webber.
Water and Pollution Control, Vol 106, No 5, p 54-57, May 1968. 5 fig, 1 tab, 11 ref.

Descriptors: *Groundwater, *Piezometry, *Water table, *Surface-groundwater relationships, *Water pollution sources, Infiltration, Wastes, Hydraulic conductivity, Subsurface drainage, Transmissivity, Head loss, Darcys law, Time lag, Nitrogen compounds, Nitrates, Discharge measurement, Discharge (Water), On-site data collections, Underflow.
Identifiers: *Hydraulic potential, Canada.

All inorganic salts of N are very soluble in water and N in the nitrate form is particularly hazardous for both humans and livestock. Barnyards and feedlots may be prime sources of inorganic N in groundwater. A piezometric network was installed radially throughout a barnyard for determination of groundwater discharge out of the barnyard so that it could be correlated with the changes in the N concentration of the water as it passed beneath the barnyard. The active head of water in a given piezometer was measured at different times. Its basic time lag, together with the geometry of the piezometer, could be used to calculate hydraulic conductivities from a large number of sites. These were then used to construct a map of isopotential lines indicating changes in hydraulic potential with distance. A simplifying assumption was that hydraulic potential did not vary vertically in the

water table to bedrock. Together with N measurements at various depths to bedrock, the results showed that the barnyard contributed 0.00189 lb N/hr to the groundwater, or about 17.5 lb N/yr. This was considered surprisingly low, since the manure of a single cow could produce 74 lb N/yr. (Casey-Arizona)
W70-07766

DOES ARTIFICIAL GROUND WATER RECHARGE CONTAMINATE OUR GROUND WATERS,
Texas Tech Univ., Lubbock. Dept. of Agricultural Engineering; and Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 04B.
W70-07771

SWAP CHEMICALS FOR CLEANER STREAMS,
Wesleyan Univ., Middletown, Conn.
N. W. Masselli, and M. G. Burford.
Textile Industries, Vol. 125, No. 2, p120-144, 1961. 13 ref.

Descriptors: Pollution source, *Biochemical Oxygen Demand, *Waste water treatment.
Identifiers: *Cotton processing wastes, *Wool processing, Chemical replacement, *Waste water analysis.

The article is in two parts; one dealing with cotton processing and stream pollution, and the other with wool processing and stream pollution. Since all cotton cloth processed by mills must be desired, the desizing process is shown to contribute approximately 70% of the total BOD of a mill. Because BOD is a pollution problem, the replacement of the high BOD process chemicals to reduce pollution is feasible. From the data presented it is clear that high BOD starch must be replaced. When dealing with the wool processing, only the scouring, dyeing, and wash after fulling are of interest, since liquid discharges are produced only in these processes. Any pollution reduction plan for scouring and finishing mills must involve the scouring and wash after fulling wastes, since they produce about 89% of the total plant BOD. In order to obtain a complete picture of the actual BOD sources in the wool effluent, the chemical nature of the discharged compounds must be determined. (Rhine-North Carolina State)
W70-07972

COMMONWEALTH V DOUGHERTY (POLICY BEHIND LICENSING OF PLUMBERS).
For primary bibliographic entry see Field 05G.
W70-08063

NUMERICAL ANALYSIS OF DISTRIBUTION OF FLOW AND THERMAL DIFFUSION CAUSED BY OUTFALL OF COOLING WATER,
Central Research Inst. of Electric Power Industry, Tokyo (Japan).
Akira Wada.
13th Congress of the International Association for Hydraulic Research, 31 Aug - 5 Sept, 1969, Proc. Vol 3, Subject C, p 335-342. 11 fig.

Descriptors: *Thermal diffusion, *Coding water, Numerical analysis, Temperature, Numerical model, Richardson number, *Flow.
Identifiers: *Entrainment.

The problem of flow and thermal diffusion in the sea caused by outfall of warmed cooling water is considered. Theoretical studies and model investigations have been made on the conditions under which entrainment occurs in a two layer flow. Ellison and Turner defined the equations of continuity of mass deficiency A and for entrainment coefficient E. Experimental results show that entrainment occurs for the condition of the interfacial gradient exceeding 0.04. The numerical experiment is conducted for the model of a simple semi infinite sea basin with a two layer system. This model contains seven nonlinear partial differential equations. Attention is confined to the time-dependent response of a two-layer sea. The result shows that the decrease of the temperature of discharged warm water is not only due to the entrainment from lower layer, the horizontal mixing with the surrounding water and the heat emission to the atmosphere, but also due to the entrainment of surface water along the coastal line into the main flow. (Upadhyaya-Vanderbilt)
W70-08131

SYMPOSIUM ON WASTE-DISPOSAL PROBLEMS OF SOUTHERN MILLS,
American Association of Textile Chemists and Colorists, Durham, N.C.
R. Hobart Souther.
American Dyestuff Reporter, Vol 44, No 12, p 379-400, 1955. 9 ref, 3 fig, 22 tab.

Descriptors: *Biological treatment, Waste water treatment, Waste water disposal.
Identifiers: *Slashing, *Sizing, *Bleaching wastes, *Dyehouse wastes, *Recovery (Waste), *Caustic soda, Textile mill wastes, Bleaching.

The papers, deal with problems of stream pollution from textile processing. Two types of research are required in solving waste-disposal problems: (1) local research and (2) research that is applicable generally. Five of the eleven papers described specific pollution control techniques: cotton slashing with synthetic compounds, bleaching and dyehouse waste studies; textile waste treatment in Texas; biological treatment of highly alkaline wastes; pollution control by recovery of caustic soda. The other six papers deal with stream classification, national waste studies, and federal pollution laws. (Sheffield-North Carolina State Univ)
W70-08141

5C. Effects of Pollution

STRATIFICATION OF FLOW FROM CHANNEL INTO DEEP LAKE,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 02H.
W70-07661

SUBSTRATE UTILIZATION IN HETEROGENOUS COMMUNITIES,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 05D.
W70-07808

EFFICACY OF METHYLPENTYNOL AS AN ANESTHETIC ON FOUR SALMONIDS,
Bureau of Sport Fisheries and Wildlife, LaCrosse, Wis. Fish Control Lab.
Robert M. Howland, and Richard A. Schoettger.
Investigations in Fish Control, No 29, 1969. 10 p, 1 fig, 5 tab, 19 ref.

Descriptors: *Fish physiology, Rainbow trout, Brown trout, Brook trout, Lake trout, Water temperature, *Fish behavior, Fish management, *Evaluation, Laboratory tests, Equilibrium.
Identifiers: *Anesthetic, *Methylpentynol, *MS-222, Narcosis, Drug.

Effective concentrations of methylpentynol for anesthetizing rainbow trout, brown trout, brook trout, and lake trout, were determined by a series of tests. Concentrations of 1.5 to 8 parts per thousand induced anesthesia. Changes in pH or in water hardness had no significant effect on the rate of anesthesia. Repeated anesthesia had little effect on rate of response. The efficacy of anesthetic solutions was reduced by continuous use. Approximately 1 kilogram of rainbow trout could be effectively narcotized per milliliter of drug. Methylpentynol was compared with MS-222 as a fish anesthetic. Fifty - times as much methylpentynol was necessary to yield the equivalent effect of 100 parts per million of MS-222. (See also W70-07840 and W70-07841). (Sjolseth-Washington)
W70-07839

TOXICITY OF METHYLPENTYNOL TO SELECTED FISHES,
Bureau of Sport Fisheries and Wildlife, La Crosse Wis. Fish Control Lab.
Leif L. Marking.
Investigations in Fish Control, No 30, 1969. 6 p, 5 tab, 16 ref.

Descriptors: *Bioassay, *Toxicity, *Mortality, *Fishkill, Rainbow trout, Brown trout, Brook trout, Lake trout, Pikes, Channel catfish, Bass, Walleye, *Resistance, *Lethal limit, Water temperature, Fish physiology, Fish management.
Identifiers: *Methylpentynol, Drug, *Anesthetic, Bluegills.

Methylpentynol was tested in 96-hour bioassays for its toxicity to rainbow trout, brown trout, brook trout, lake trout, northern pike, channel catfish, bluegills, largemouth bass, and walleyes. The LC50's range from 660 to 1,890 parts per million at 12 deg C. Channel catfish are the most resistant and lake trout are the most sensitive. Two-inch rainbow trout, brown trout, and lake trout are more sensitive to methylpentynol than larger ones in 96 hour exposures. The drug is more toxic to bluegills at 17 deg than at 12 deg C. Toxicity was not influenced in different water hardnesses of 10 to 180 parts per million. (See also W70-07839 and W70-07841). (Sjolseth-Washington)
W70-07840

ANNOTATED BIBLIOGRAPHY ON METHYLPENTYNOL,
Bureau of Sport Fisheries and Wildlife, La Crosse Wis. Fish Control Lab.
Gerald E. Svendsen.
Investigations in Fish Control, No 31, 1969. 5 p, 26 ref.

Descriptors: *Bibliographies, *Reviews, *Fish physiology, *Analytical techniques, Fish behavior, Fish management.
Identifiers: *Methylpentynol, Anesthetic, *Annotated bibliography.

Experiments with methylpentynol as an anesthetic for four salmonids to describe its toxicity and efficacy began in 1964 at the Fish Control Laboratory, La Crosse, Wis. The U.S. Food and Drug Administration requires these data for clearance and labeling of drugs. During the study, a number of selected references on fishery uses of the drug, and on its biochemistry, physiology, and methods of analysis were annotated. (See also W70-07839 and W70-07840). (Sjolseth-Washington)
W70-07841

ENHANCEMENT BY CLYCEROL OF PHOTOTROPHIC GROWTH OF MARINE PLANKTONIC ALGAE AND ITS SIGNIFICANCE TO THE ECOLOGY OF GLYCEROL POLLUTION,
Fisheries Research Board of Canada, Vancouver (British Columbia). Vancouver Lab.
Joseph Y. Cheng, and Naval J. Antia.
Journal of the Fisheries Research Board of Canada, Vol 27, p 335-346, 1970. 11 fig, 2 tab, 16 ref.

Descriptors: Organic wastes, Water pollution effects, *Algae, Phytoplankton, Diatoms, Chrysophyta, Chlorophyta, *Growth rates, Inhibition, *Plant physiology, *Plant growth, Plant growth substances, Plant morphology.
Identifiers: *Glycerol, *Phototrophic growth, *Marine phytoplankton (Prymnesium parvum, (Chroomonas salina), Glycerol pollution.

The effects of low (0.05 M) and high (0.5-1.0 M) concentrations of glycerol on the growth of 18 species of marine phytoplankters were studied. The

gae were grown in axenic culture in sea water enched with nitrate, orthophosphate, silicate, traceetal ions, vitamin B12, thiamine, biotin, and bufred at pH 7.6-7.8. Apart from a chrysomonad (Pmnesium parvum and a cryptomonad Chroomonas salina), none of the species showed y significant growth on glycerol in the absence of ht. However, in the presence of light, glycerol hanced the growth of 16 species, in particular embers of the Chrysophycyeae and Cryptphyceae, one diatom (Phaeodactylum tricornutm), one rhodophyte (Porphyridium cruentum), d one chlorophyte (Nannochloris oculata). The hancement effect was observed in the growth te and in the peak population density, which in any instances was several times that from noncerinated cultures and suggested otoheterotrophic growth. Some species showed vious cytological and metabolic changes from owth on glycerol. (Sjolseth-Washington)
70-07842

HE BIOLOGICAL RECOVERY OF THE LINCH RIVER FOLLOWING A FLY ASH ND SPILL,
rginia Polytechnic Inst., Blacksburg. Dept. of ology.
hn Cairns, Jr.
oceedings Industrial Waste Conference, 25th, ld May 5-7, 1970 at Purdue University, Typespt. 22 p, 8 fig, 1 tab, 5 ref.

escriptors: Biological communities, *Water pollion effects, *Fly ash, Hydrogen ion concentran, *Fishkill, Dissolved oxygen, Impaired water ality, Benthic fauna, Water pollution sources, ayflies, Mollusks, *Community development, n-site investigations, *Fish food organisms, versification, Midges, Aquatic insects, Food ebs, Stoneflies.
entifiers: *Biological recovery, *Clinch River, Community structure analyses.

June, 1967, highly caustic water from a fly ash ttling lagoon spilled into the Clinch River killing er 200,000 fish in 90 miles of river in Virginia d Tennessee. During the summer and fall of 69, a bottom fauna and fish survey was conicted to determine the extent of biological covery. Two years after the spill, the Clinch River d not fully recovered. Bottom fauna communis had the same number of organisms; however, eir densities were down from the upstream conol stations. The authors felt that since fish food ganisms such as mayflies and stoneflies were esent at all the 'spill areas' a productive sport hery could be supported. (Sjolseth-Washington)
70-07843

FFECTS OF METAL POISONING ON FIVE VER ENZYMES IN THE KILLIFISH (FUNDUUS HETEROCLITUS),
ational Marine Water Quality Lab., Kingston, R.I.
gene Jackim, Janice M. Hamlin, and Stephen nis.
urnal of the Fisheries Research Board of Canada, ol 27, p 383-390, 1970. 1 fig, 2 tab, 13 ref.

escriptors: Water pollution effects, Bioassay, shkill, Mortality, *Fish physiology, *Enzymes, llifishes, *Heavy metals, *Copper, *Inhibition, nibitors.
entifiers: *Liver enzymes, Acid phosphatase, Alline phosphatase, Catalase, Xanthine, Oxidase, bonuclease, *Metal poinsoning, Lead, Mercury, ryllium, Cadmium, Silver.

ctivities of five liver enzymes (acid and alkaline osphatase, catalase, xanthine oxidase, and onuclease) from Fundulus heteroclitus surviving posure to 96-hr TLm concentrations of salts of metals (lead, copper, mercury, beryllium, cadum, and silver) differed markedly from those of exposed fish. Changes in enzyme activity oduced by the exposures were not necessarily the me in magnitude or direction as those observed en the salts were introduced directly into the enzyme preparations. It is proposed that changes in liver enzyme activity may be useful as a kind of biochemical autopsy tool for diagnosing sublethal metal poisoning in fish. (Sjolseth-Washington)
W70-07844

RESIDUES IN FISH, WILDLIFE, AND ESTUARIES - ORGANOCHLORINE PESTICIDES IN FUR SEALS,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
Raymond E. Anas, and Alfred J. Wilson, Jr.
Pesticides Monitoring Journal, Vol 3, No 4, p 198-200, March 1970. 1 tab, 4 ref.

Descriptors: *DDT, *Chlorinated hydrocarbon pesticides, *Dieldrin, *Pesticide residues, Gas chromatography, Alaska, Washington.
Identifiers: *Polychlorinated biphenyls, *Fur seals, *Callorhinus ursinus, *DDE, DDD, Pribilof Islands, Alaska, Brain tissue.

Samples of liver and brain tissue from 30 northern fur seals (Callorhinus ursinus) and 7 fur seal fetuses that were collected on the Pribilof Islands, Alaska, in 1968 and off the Washington coast in 1969, were analyzed for organochlorine pesticides. These compounds were found in all of the fur seals and in three of the fetuses. Polychlorinated biphenyls (PCB) were not detected. Of 30 samples of liver tissue from the seals, all contained DDE; 21, DDD; 24, DDT; and 3 contained dieldrin. Of the 30 brain samples, all contained DDE; 5, DDD; 4, DDT; and none contained dieldrin. DDE was present in liver tissue from three of the fetuses and in brain tissue from two. (Sjolseth-Washington)
W70-07845

EFFECTS OF NITRATE OF CULTURE WATER ON THE GROWTH OF THE JAPANESE PEARL OYSTER (IN JAPANESE),
National Pearl Research Lab., Ago (Japan).
Yukimasa Kuwatani, Tamotsu Nishii, and Fumio Isogae.
English summary. Bulletin of the National Pearl Research Laboratory, Vol 4, p 1735-47, 1969. 11 fig, 3 tab, 15 ref.

Descriptors: *Nitrates, Oysters, Cultural control, *Growth rates, *Water quality, Water quality control, Mortality, *Nitrities, Phosphates, Hydrogen ion concentration, Ammonia, Calcium.
Identifiers: Japanese pearl oyster, *Pinctada fucata, *Culture water.

Thirty, one-year-old pearl oysters were divided into six groups of 5 animals each and reared in recirculating tanks for 52 days. Nitrate content of the rearing water was kept at various levels in the five tanks by adding necessary amounts of sodium nitrate to the water. Average nitrate contents in the control tank and the 5 experimental tanks were 11, 588, 1116, 2478, 5151 and 10540 /ug-at N/1, respectively. As the amount of nitrate added increased, the nitrite content of rearing water increased and the phosphate content decreased. Chemical factors other than nitrite and phosphate showed no marked differences among the tanks. The growth of the oysters during the experimental period in the six tanks in order of increasing nitrate content was 432,416, 496, 428, 316 and 370 mg per oyster in cumulative increase of under-water weight. The authors concluded that nitrate less than 10000 /ug-at N/1 in rearing water has no harmful influences on the growth of oysters under the conditions that pH of seawater is over 8.05 (average, 8.09) and alkalinity is over 1.96 (average, 2.10) mN. (Sjolseth-Washington)
W70-07846

THE RESPONSE OF FRESH-WATER PROTOZOAN COMMUNITIES TO HEATED WASTE WATERS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Biology.
John Cairns, Jr.
Chesapeake Science, Vol 10, No 3 and 4, p 177-185, 1969. 12 ref, 8 fig.

Descriptors: *Water pollution effects, Water pollution sources, *Thermal pollution, Thermal powerplants, *Thermal stress, Thermal water, *Protozoa, Algae, Diatoms, Animal behavior, *Thermodynamic behavior.
Identifiers: *Temperature shock, *Protozoan communities, Potomac River, Savannah River, Shock effects.

The response of fresh-water protozoan communities exposed to both severe acute temperature shocks as well as small gradual long-term increases are discussed. The former experiments were carried out in plastic troughs with a constant flow of unfiltered lake water. Severe acute shocks (some to nearly 50 C) resulted in a marked reduction in number of species present. However, recovery was quite rapid (a matter of a few days) once the temperature stress ceased. Observations of the effects of small gradual long-term increases were made on the protozoan communities of the Savannah and Potomac rivers each of which received heated waste water discharges. Each of these studies covered a period in excess of nine years and observations are still being made. There was no evidence that indicated the protozoan communities of these rivers had been degraded by the small gradual temperature increases resulting from the discharge of heated waste waters. However, there is evidence that competitive exclusion of algal species by other more tolerant algal species may cause qualitative shifts in the community structure which may be undesirable. (Sjolseth-Washington)
W70-07847

BIOASSAY OF KING SALMON EGGS AND SAC FRY IN COPPER SOLUTIONS,
California State Dept. of Fish and Game, Sacramento. Water Projects Branch.
Charles R. Hazel, and Stephen J. Meith.
California Fish and Game, Vol 56, No 2, p 121-124, 1970. 3 tab, 4 ref.

Descriptors: *Bioassay, *Copper, Copper sulfate, Heavy metals, Chinook salmon, Fish eggs, Fry, Effects, *Toxicity, Mortality, Growth rates, Inhibition, Water pollution effects, Lethal limit.
Identifiers: *Hatching success.

Flowing water bioassay of chinook salmon (Oncorhynchus tshawytscha) eggs and fry in a copper solution indicated that eggs are more resistant to the toxic effects of copper than fry. Copper concentrations of 0.08 mg/liter did not noticeably affect the hatching success of eyed eggs, but concentrations as great as 0.04 mg/liter were acutely toxic to fry and concentrations of 0.02 mg/liter caused increased mortality and inhibited growth. (Sjolseth-Washington)
W70-07848

EFFECTS ON THE GROWTH OF JAPANESE PEARL OYSTER OF THE VARIOUS ALKALINE REAGENTS ADDED TO THE CULTURE WATER FOR THE CONTROL OF ITS pH (IN JAPANESE),
National Pearl Research Lab., Ago (Japan).
Yukimasa Kuwatani, and Tamotsu Nishii.
English summary. Bulletin of the National Pearl Research Laboratory, Vol 13, p 1597-1616, July 1968. 19 ref, 16 fig, 4 tab, append.

Descriptors: Oysters, Alkaline water, Alkalinity, Alkali metals, *Growth rates, *Hydrogen ion concentration, Cultural control, *Water quality, Water quality control, Carbon dioxide, *Sodium, *Sodium compounds, *Calcium hydroxide, Bicarbonates, Ammonia, Nitrates, Nitrites.
Identifiers: Japanese Pearl Oyster, *Pinctada fucata, *Culture water, *Barbital sodium, *Sodium borate, *Sodium carbonate, *Sodium hydroxide, *Tris-buffer, Carbonate ions.

Thirty five one-year-old pearl oysters were equally divided into 7 groups, which were reared in separate recirculating tanks containing various alkaline reagents (6 were tested) for 56 days. The pH was maintained above 8.0.Tris-buffer or barbital sodium required by far the greatest amount to maintain the pH value of culture water above 8.0, and they were followed by sodium borate, sodium hydroxide, calcium hydroxide and then sodium carbonate. The partial pressure of carbon dioxide was the highest in the culture water added barbital sodium or Tris-buffer, and the second highest in that added sodium borate, while the remaining reagents gave as low values as control. The Tris-buffer-added culture water exhibited a remarkably high level for ammonia, nitrite and nitrate as compared with the case of the other alkaline reagents. From the cumulative growth patterns of pearl oysters reared it was possible to class the seven differently treated groups of oyster as follows: (a) Sodium borate and barbital sodium oyster groups showed the most rapid growth. (b) Calcium hydroxide and sodium carbonate oyster groups showed a slow continuous growth. (c) Sodium hydroxide and Tris-buffer oyster groups showed a decline in weight. (d) Control oyster groups showed a negative growth in weight. Authors concluded that the artificial control of pH of the culture water by alkaline reagents created a favorable condition for the growth of pearl oysters. The reagents which brought about the most rapid growth possessed a considerably low dissociation degree. (Sjolseth-Washington)
W70-07849

RELATION BETWEEN ENVIRONMENTAL CHARACTERISTICS OF WATERS AND CHANGES OF PHYTOPLANKTON IN AN ESTUARY WHERE RED TIDE OFTEN APPEARS (IN JAPANESE),
Mie Prefectural Univ., Tsu (Japan).
Fukuzo Uyeno.
English summary. Bulletin of the Plankton Society of Japan, Vol 16, No 2, p 89-98, 1969. 1 tab, 6 fig, 22 ref.

Descriptors: Environmental effects, Phytoplankton, *Red Tide, Dinoflagellates, Bottom sediments, Essential nutrients, Nutrient requirements, Estuarine environment, Dissolved oxygen.
Identifiers: Skeletonema costatum, *Environmental conditions, Ago Bay, Japan.

The relationship between environmental conditions, especially about the depletion of dissolved oxygen near the bottom, and the occurrence of nannoplankton in an area where red tides often occur was observed in Ago Bay, from 1966 till '68. Land-drainages and upwelled waters from the bottom layers supplied inorganic nutrient salts for phytoplankton bloom. This produced a rapid increase of chlorophyll-a at the surface and in the mid-layer. The former mainly consists of Skeletonema costatum and the latter of flagellates including dinoflagellates. Author concluded that the superficial bottom mud is a source of both inorganic nutrients and trace growth acceleration substances. This analysis of the mechanism of supply of such substances to the water in relation to seasonal changes of environmental conditions and species occurrence will be required for future study. (Sjolseth-Washington)
W70-07850

STUDIES ON THE EFFECTS OF SEVERAL AGRICULTURAL CONTROL CHEMICALS ON THE SPAWNING OF WILD GOLD FISH (CARASSIUS CARASSIUS CUVIERI T. et S.) AND THE HATCHING OF THE EGGS (IN JAPANESE),
Freshwater Fisheries Research Lab., Tokyo (Japan)
Sekio Kimura, and Masahiro Matsushima.
English synopsis. Bulletin of Freshwater Fisheries Research Laboratory, Vol 19, No 2, p 121-135, 1969. 7 tab, 30 ref.

Descriptors: Bioassay, *Mortality, *Dieldrin, *Chlorinated hydrocarbon pesticides, Pesticide toxicity, Fish reproduction, Carp, Water pollution effects, Lethal limit, *Organophosphorus pesticides, *Spawning, Fish eggs, Viability, Hatching, Fish behavior.
Identifiers: *Dipterex, Ethyl parathion, *Lindane, PCP-Na, *MCPCA, Gold fish, Tolerance, Carassius carassius.

The effects of dipterex, ethyl parathion, dieldrin, lindane, PCP-Na, and MCPCA on the spawning of gold fish and the hatching of their eggs were studied. The following conclusions were obtained: The chemicals tested did not affect adult wild gold fish, their spawning ability, or the eggs at the concentrations of 0.1x48 hr TLm for carp fry. Deleterious effects were observed at the concentrations higher than 0.5x48 hr TLm. The authors stress the need to understand the biological effects of chlorinated hydrocarbon and other pesticides which easily accumulate in fish. (Sjolseth-Washington)
W70-07851

SENSITIVITY OF POND FISH TO COTNION (AZINPHOSMETHYL) AND PARATHION,
Hebrew Univ., Jerusalem (Israel). Dept. of Microbiological Chemistry.
M. Lahav, and S. Sarig.
Bamidgeh, Bulletin for Fish Culture in Israel, Vol 21, No 3, p 67-74. 4 tab, 9 ref.

Descriptors: Organophosphorus pesticides, Carp, Mullets, *Pesticide toxicity, *Bioassay, Mortality, Toxicity, Resistance, *Lethal limit, Fishkill.
Identifiers: *Cotnion, *Azinphosmethyl, *Parathion, Tilapia, Median tolerance limit.

In recent years there have been a large number of poisonings of pond fish killing by pesticides applies to field crops adjoining the ponds. In order to limit damage due to this cause, it was necessary to determine the lethal dosages of these pesticides for the various pond fish species, as well as the permissible concentrations which do not cause damage under the given conditions. (Sjolseth-Washington)
W70-07852

EFFECTS OF NITROGEN LIMITATION ON THE GROWTH AND COMPOSITION OF UNICELLULAR ALGAE IN CONTINUOUS CULTURE,
School of Aerospace Medicine, Brooks AFB, Tex.
For primary bibliographic entry see Field 05D.
W70-07957

WASTE WATER TREATMENT IN MODERN TEXTILE OPERATIONS (IN GERMAN),
For primary bibliographic entry see Field 05D.
W70-07977

SOME LONG-TERM TRENDS IN WATER QUALITY OF RIVERS AND LAKES,
Illinois State Water Survey, Urbana.
William C. Ackermann, Robert H. Harmeson, and Robert A. Sinclair.
Transactions, American Geophysical Union, Vol. 51, No. 6, p 516-522, June 1970. 6 fig.

Descriptors: *Water quality, *Standards, *Pollution abatement, Sulfates, Alkalinity, Chlorides, Dissolved solids, Nitrates, Lake Michigan, Mississippi River, Ohio River.
Identifiers: *Metropolitan areas, Illinois River.

Long term trends of water quality have been examined on reasonably continuous measurements of conservative water quality elements on four areas of significant size. Of particular interest were large areas that reflected major population and technological consequences, and locations where the water quality, in turn, was of importance to a large number of present and future users. The four areas studied were: the southwest shore of Lake Michigan; the Mississippi River at Alton, Illinois the Illinois River at Peoria, Illinois, and the Ohio River at Cairo, Illinois. Five parameters of water quality were examined: chlorides, sulfates, nitrates total dissolved solids, and alkalinity. It was concluded that in recent years accelerated pollution abatement efforts for the parameters and areas studied do not appear to have reversed the trend of increasing waste burdens, much less returned us to the levels of seventy or more years ago. One's degree of concern about this depends upon criteria or benchmarks; but one statement can be made with some confidence: we have not yet overcompensated. (Davis-Chicago)
W70-07983

ULTRASONIC EMULSIFICATION OF OIL TANKER CARGO, FEASIBILITY STUDY USING AN ULTRASONIC PROCESS TO EMULSIFY PETROLEUM TO REDUCE OIL SLICK HAZARDS IN EVENT OF SPILLAGE AT SEA.
Sonics International, Inc., Dallas, Tex.
For primary bibliographic entry see Field 05G.
W70-07996

EFFECTS OF INSECTICIDES ON ALGAE,
Ontario Water Resources Commission, Toronto. Div. of Research.
A. E. Christie.
Water and Sewage Works, Vol 116, p 172-176, 1969. 6 tab, 31 ref.

Descriptors: *Algae, *Insecticides, Toxicity, Degradation (Decomposition), DDT, Alkalinity, Stabilization, Waste storage, Ponds, Hydrolysis, Metabolism, Chemical reactions, Chlorella, Tracers, Radioactivity, Carbon radioisotopes, Hydrogen ion concentration, Scenedesmus, Euglena, Bacteria, Yeasts, Actinomycetes, Ponding, Waste treatment.
Identifiers: Sevin, Malathion, Chlorella pyrenoidosa, Schroderia, Thimet, Trichoderma.

DDT, Sevin, and Malathion were studied to determine their effect on algal populations associated with waste stabilization ponds and their possible degradation in an algal environment. The pesticides vary in degree of toxicity to algae and in extent to which they are degraded in presence of algae. DDT exhibited no toxic properties up to concentrations of 100 milligrams/liter and received only slight degradation. Sevin is toxic at concentrations above 0.1 milligrams/liter and is not altered appreciably in acidic media. Malathion appears to receive extensive conversion and, although capable of altering composition of a mixed algal community, did not display persistent inhibitory effect. Extending this to the alkaline waste stabilization pond and its algal community, entry of DDT, up to 100 milligrams/litee, is not likely to be toxic nor will the material be degraded by algae. A similar quantity of Sevin would seriously reduce efficiency of the pond with conversion more likely to occur by alkaline hydrolysis than algal metabolic processes. An equivalent slug of Malathion, although temporarily interrupting operation of the pond, could be broken down rapidly by chemical and metabolic reactions. (Jones-Wisconsin)
W70-08097

INSECTICIDE RESIDUES IN SOME COMPONENTS OF THE ST LAWRENCE RIVER ECOSYSTEM FOLLOWING APPLICATIONS OF DDD,
Department of Agriculture, Saskatoon (Saskatchewan); and Saint Dunstan's Univ., Charlottetown (Prince Edward Island). Dept. of Chemistry.
F. J. H. Fredeen, and J. Regis Duffy.
Pesticides Monitoring Journal, Vol 3, No 4, p 219-226, 1970. 4 tab, 14 ref.

Descriptors: *Insecticides, *St Lawrence River, Water pollution sources, Water pollution effects, Mud, Mollusks, Fish, Insects, DDT, Silts, Suckers, Catfishes, Bass, Perches, Pikes, Sampling, Snails,

lgae, Diatoms, Clams, Shellfish, Amphipoda, Vater birds, Wisconsin, Analytical techniques.
lentifiers: *Residues, *DDD, DDE, TDE, Black- y larvae, Cladophora, Cyprinus carpio, 'atostomus commersoni, Ameiurus nebulosus, erca flavescens, Ambloplites rupestris, Esox lu- ius, Campeloma, Psidium, Shadfly, Chironomids, lear Lake (Calif), Richelieu River (Quebec), ireen Bay (Wis), Mackerel, Montreal (Canada).

DD (TDE) residues were measured in water, ud, mollusks, and fish of the St Lawrence River in 967 during and after applications of DDD to con- ol nuisance insects. Concentrations detected in ater (up to 0.0139 ppm) ranged from 1 to 17% of ose applied to the river 10 miles upstream. DDD oncentrations in mollusks 17 miles upstream from e point of application and 10 and 45 miles ownstream, averaged 0.002, 0.101, and 0.0 ppm, espectively. In the same samples, concentrations f DDT and DDE combined (from unknown ources) averaged 0.030, 0.225, and 0.027 ppm. In dible flesh from 216 fish of 5 species, DDD esidues averaged 0.156 ppm in samples collected 7 miles upstream and 0.369 in the combined sam- les from points 10 and 45 miles downstream. esidues of DDT plus DDE in these same samples veraged 0.224 and 0.227 ppm, respectively. The ighest concentration of DDD in an individual fish as 1.81 ppm. The ultimate fate of the DDD, that is s conversion to materials with reduced toxicities, poorly understood. DDD is itself a product of the eductive dechlorination of DDT in nature. (Jones- Visconsin)
W70-08098

QUANTITATIVE METHOD FOR ASSESSING HE TOXIC EFFECTS OF SOME WATER OLUBLE SUBSTANCES, BASED ON HANGES IN PERIPHYTON COMMUNITY TRUCTURE,
ttawa Univ. (Ontario). Dept. of Biology.
like Dickman.
Vater Research, Vol 3, p 963-972, 1969. 4 fig, 1 ab, 11 ref.

escriptors: *Data collections, *Toxicity, Periphyton, *Water pollution effects, *Water pol- tion, Water chemistry, Biological communities, akes, Streams, Diatoms, Silica, Chlamydomonas, hlorella, Chlorophyta, Sampling, Resins, Ef- uents, Methodology, Monitoring, Water quality, Vater pollution sources, Water analysis, Analytical chniques.
lentifiers: *Soluble substances, Germanium diox- e, Diversity index, Lago Banolas (Spain).

method to assess the potential damage of a par- cular water soluble compound released in lakes nd streams is described. The results of a test, using ermanium dioxide which has a known effect, pro- ded evidence that quantitative changes in the spe- es composition of the colonizing periphyton com- unity reflect the nature of the toxicant to which ey were exposed. Natural diatom growth in the resence of germanium was inhibited and the ensu- g changes in the species composition of the eated community were reflected in changes in the versity index. The major disadvantage in applying is technique to general usage is that the concen- ation of the toxicant at the gel-water interphase is either controllable nor known under the condition escribed for this experiment. However, anti-foul- g resins are available for which the leaching rates chemicals with different solubility coefficients nd for different current velocities are known. The ajor advantage of this technique is its wide poten- al applicability. Wherever a pollutant, such as an secticide, is suspected, it could be impregnated in gel and exposed to the periphyton in the same or similar area as that into which the toxicant would released. (Jones-Wisconsin)
70-08101

ESTICIDES IN WATER,
attelle Memorial Inst. Richland, Wash.; and gricultural Research Service, Prosser, Wash. rops Research Div.
J. L. Nelson, V. F. Bruns, C. C. Coutant, and B. L. Carlile.
Pesticides Monitoring Journal, Vol 3, No 3, p 186-189, 1969. 2 tab, 6 ref.

Descriptors: *Pesticides, *Copper sulfate, *Irrigation canals, Suspended load, Sediments, Bottom sediments, Algicides, Washington, Sampling, Aquatic weeds, Chlorophyta, Rooted aquatic plants, Rainbow trout, Crops, Washington.
Identifiers: Sunnyside (Wash), Rhodamine-B.

Chemical and physical behavior was determined of copper sulfate applied as algicide in irrigation canal water. Measurements of copper concentrations in water, in suspended sediment, and in bottom sediment of an irrigation canal after a copper sulfate treatment at 1 pound/cubic feet per second indicate that, after dissolution, much of the copper is sorbed by suspended sediment which gradually settles to the canal bottom. A large part of the copper in the deposited sediment is then slowly fed back into the canal water over a period of many hours. Copper buildup in irrigated soils appears to be minor and the possibilities of harmful effects from the release of such treated water for irrigation or domestic purposes are remote. Copper accumulation in the irrigated soil is far below levels toxic to crop plants. Similar treatments have been commonly used for decades as algae control; as far as known, harmful effects from such usage in irrigation canals have never occurred or been reported. The fish studied apparently survived because peak concentrations were of short duration and because dead algae did not accumulate to clog gills. (Jones-Wisconsin)
W70-08102

THE NEWEST DEVELOPMENT IN LAKE LUCERNE (IN GERMAN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 02H.
W70-08106

THE ADAPTATION OF PLANKTON ALGAE. V. VARIATION IN THE PHOTOSYNTHETIC CHARACTERISTICS OF SKELETONEMA COSTATUM CELLS GROWN AT LOW LIGHT INTENSITY,
Royal Danish School of Pharmacy, Copenhagen. Dept. of Botany.
For primary bibliographic entry see Field 02K.
W70-08110

THE INHIBITORY EFFECTS OF COPPER ON MARINE PHYTOPLANKTON,
Dow Chemical Co., Freeport, Tex. Texas Div.
E. F. Mandelli.
Marine Science, Vol 14, p 47-57, 1969. 6 fig, 1 tab, 21 ref.

Descriptors: *Marine water, *Copper, *Algae, Sea water, Temperature, Salinity, Bioassay, Analytical techniques, Lethal limits, Dinoflagellates, Diatoms.
Identifiers: *Copper chloride, Uptake, Freundlich isotherm, Blue-green algae, Green algae.

The growth of several species of dinoflagellates and diatoms in batch cultures under continuous illumination was inhibited at 20C by concentration of copper between 0.055 and 0.265 microgram/milliliter. Coccochloris elabans failed to grow at 0.03 microgram/milliliter and 40C, whereas Dunaliella tertiolecta survived 0.6 microgram/milliliter at 30C. Skeletonema costatum in light-dark cultures with maintenance of constant number of cells and copper ions was inhibited at 0.05 microgram/milliliter. A positive correlation was found between the log of copper uptake:biomass of algae ratio and the temperature, and a negative correlation between the same ratio and salinity. (Wilde-Wisconsin)
W70-08111

A SIMPLE METHOD OF ASSESSING THE ANNUAL PRODUCTION OF STREAM BENTHOS,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 07B.
W70-08113

INVESTIGATIONS OF THE EFFECT OF THE DISTRIBUTION OF SEWAGE EFFLUENT IN LAKES (IN GERMAN),
Kantonales Laboratorium, Zurich (Switzerland).
E. A. Thomas.
English summary. Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 517-528, 1969. 4 fig, 3 tab, 9 ref.

Descriptors: *Water pollution effects, *Lakes, *Sewage effluents, *Sewage, Industrial wastes, Chemical analysis, Analysis, Coliforms, Bacteria, Phenols, Potable water, Chlorination, Phosphates, Hydrogen ion concentration.
Identifiers: *Chlorophenols, Bacteriological analysis, Iron chloride, Lake Zurich, Lake Pfaffikon.

The distribution path of purified sewage effluent in Lake Pfaffikon was traced by chemical and bacteriological analyses. The sewage travelled intact from the shore down the slope to a depth of 5 meters and then spread out horizontally. The industrial effluent, contaminated with phenol, entered Lake Zurich at a depth of 31 meters and was diverted by the current over a distance of 2200 meters to the intake of drinking water. The chlorination of water gave rise to chlorophenols thereby rendering water unpalatable to 80,000 people for a period of 1 to 2 days. (Wilde-Wisconsin)
W70-08115

THERMAL LOADING-NEW THREAT TO AQUATIC LIFE,
Maryland Univ., College Park. Dept. of Environmental Research.
Joseph A. Mihursky.
Catalyst, Vol. 2, No. 3, p 6-9, (1969). 2 fig.

Descriptors: *Thermal pollution, *Aquatic life, *Cooling water, Powerplants, Metal pipes, Cooling towers, Nuclear energy, Chlorine, Seasonal, Oysters, Salmon, Trout, Clams, Striped bass, Shellfish, Water pollution effects.
Identifiers: Chesapeake Bay.

The problem of thermal pollution and its effect on aquatic life are examined. The excess temperatures associated with thermal pollution may cause as much as 100 per cent mortality among aquatic animals. This increase in temperature is usually caused by man's increased production of electricity. The fossil fuel powerplants of the past, however, produced less thermal pollution than our newer nuclear powerplants. These newer plants demand more cooling water than is available in the streams where water is already being used for cooling. A problem that often arises is corrosion of metal tubes. An example of the results of this corrosion is the green oyster caused by a high copper concentration in the water. There are basically three alternatives to the problem. They are: (1) ignore the problem; (2) produce electricity in a different manner; or (3) find ways to redirect waste heat. At present, two new engineering designs to help correct the problem are the evaporative cooling towers and a closed circuit cooling system similar to an automobile radiator. The author proposes further research on eleven area recommendations. (Osborne-Vanderbilt)
W70-08119

THERMAL EFFECTS: A REPORT ON UTILITY ACTION,
F. C. Olds.
Power Engineering, Vol 74, No 4, p 26-31, April 1970. 2 fig, 4 tab.

Descriptors: *Utilities, *Thermal pollution, *Surveys, Cost-benefit analysis, Cooling towers, Ponds,

Water temperature, Power system operations, Design criteria, Standards, Heat flow, Water pollution effects.
Identifiers: Mixing zone.

The results of a thermal discharge survey conducted by Power Engineering are described. The survey includes 43% of all utilities in the U.S. with 8-Mw or more of steam-electric generating capacity. Data dealing with percent of return and type of utility is listed in tabular form. The results indicated that 123 utilities of the 135 utilities reporting may not be in compliance with existing standards. Moreover, companies with higher capacities are not in compliance as much as those with lower capacities. Further, the survey showed a tendency for utilities to change from direct discharge to cooling towers for their next plants. Twenty companies estimate that they will spend 157 million dollars on new plants to ensure that they meet new water temperature standards. From this analysis, four major aspects of temperature compliance stand out clearly. They include: (1) temperature standards are a moving target; (2) mixing zones are undefined; (3) upper temperature limits are rigidly and capriciously set; and (4) as standards become more stringant, costs skyrocket. (Osborne-Vanderbilt)
W70-08122

FIELD SITES AND SURVEY METHODS,
Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering Science.
John C. Geyer, John E. Edinger, Willard L. Graves, Jr., and Derek K. Brady.
Cooling Water Studies for Edison Electric Institute, Report No 3, June 1968. 42 fig, 43 tab, 4 ref. EEI Research Project RP-49.

Descriptors: *Thermal pollution, *Meteorology, *Instrumentation, *Data collection, Heat exchangers, Thermal stratifications, Hydrographs, Powerplants, Water pollution effects.
Identifiers: *Data reduction, *Heat dissipation, Parameters, Receiving waters, Thermographs, Pyrheliometer, Dispersion coefficient.

The main features of eleven field sights are summarized and described including the survey data collection techniques used to investigate the dissipation of heat from the different types of natural waters which received the heated discharges from the eleven thermoelectric generating plants. A history of the development of this study is followed by a tabulation of the geographical and hydrological features of each study site, complete with details of types of survey instruments, survey procedures and data reduction techniques. The eleven study sites were compared first in terms of their geographic location and climate, then by groups according to type of receiving waterbody, and also in terms of their various heat dissipation characteristics. Comparisons were made between the various survey procedures adopted at each site, and between the different types of meteorological instruments used. The methods of data reduction employed at the field sites are summarized, and an outline is given of the data processing required prior to storage and retrieval for interpretation and analysis. The analytical objectives of the study are also summarized in relation to the applicability of the different study sites to these objectives. (Osborne-Vanderbilt)
W70-08123

ENVIRONMENTAL EFFECTS OF NUCLEAR COOLING FACILITIES,
Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
William P. Lowry.
American Meteorological Society, Bulletin, Vol 51, No 1, p 23-24, January 1970.

Descriptors: *Fog, *Cooling towers, Temperature, Vapor pressure, Winds, Humidity, Climatology, Atmospheric physics, Water pollution effects, *Environmental effects.
Identifiers: *Cooling ponds, Wet plumes.

The foreseeable but not quantifiable variable, fogging, was discussed. Also, the effects that cooling towers and cooling ponds might have on fogging conditions were considered. The conclusion reached after considering these environmental effects was that under the climatic conditions of western Oregon, a significant fraction of the days of each year fall in the middle of the spectrum of uncertainty, thereby representing a potential or latent fogging problem. Moreover, the scientific and engineering professions do not now have either the information or the experience necessary even to begin operational avoidance or reduction of the fogging problem which we know exists in connection with industrial cooling tower and pond facilities. (Osborne-Vanderbilt)
W70-08125

MOISTURE POLLUTION OF THE ATMOSPHERE BY COOLING TOWERS AND COOLING PONDS,
Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
E. W. Hewson.
American Meteorological Society Bulletin, Vol. 51, No. 1, p 21-22, January 1970.

Descriptors: *Atmospheric physics, *Cooling towers, Chemical wastes, Terrain analysis, Precipitation (Atmospheric), Humidity, Wetting, Air temperature, Winds, Cities, Water pollution effects.
Identifiers: *Cooling ponds, *Moisture pollution, Visibility, Icing, Sunshine.

Possible meteorological influences as could be encountered from water vapor releases from cooling towers and cooling ponds are reviewed. Such meteorological aspects as visibility, precipitation, humidity, wetting, icing, sunshine, temperature, and wind are discussed. An additional problem concerning an effluent containing chemical pollutants is considered. This consideration was made for both flat terrains and in valleys. Other terrain modifications to the atmospheric moisture problem were made for the special cases of urban areas and along shorelines. In general, the influence is likely to be local or non-existent. The possibility of greater stability of natural fogs due to heat input is increased. (Osborne-Vanderbilt)
W70-08128

TEMPERATURE TOLERANCE OF EGGS AND YOUNG OF COLUMBIA RIVER CHINOOK SALMON,
Hanford Atomic Products Operation, Richland, Wash.
P. A. Olson, and R. F. Foster.
Transactions of the American Fisheries Society, Vol 85, p 203-207, 1957. 2 fig, 2 tab, 3 ref.

Descriptors: *Chinook salmon, *Salmon, *Fish, Fish eggs, Growth stages, Fish reproduction, Fry, Columbia River, *Thermal pollution, Temperature, Seasonal, Fluctuation, Period of growth, *Water pollution effects.
Identifiers: Priest Rapids Dam.

A study was made on the temperature tolerance of eggs and young of chinook salmon which spawn in the main stem of the Columbia River. The control temperature followed a seasonal trend typical for the locality. It started at 57 deg F, reached a minimum of 36 deg F, and increased to 47 deg F at the end of the test. Other experimental lots averaged about 4 deg F colder and 2 deg F, 4 deg F, and 8 deg F warmer than the control throughout the greater part of the test. Significant mortality above that of the control occurred only in the warmest lot. Although about 90 percent of the eggs in this group hatched successfully, the fry and early fingerlings suffered heavy mortalities even though the mean temperature of this lot was well below 50 deg F during the fingerling stage. The results of this single experiment indicated that the eggs could begin incubation at temperatures as high as 61 deg F without significant loss. (Speakman-Vanderbilt)
W70-08129

NUCLEAR POWER AND THERMAL POLLU TION: ZION, ILLINOIS,
Argonne National Lab., Ill. Radiological Physic Div.
Philip F. Gustafson.
Bulletin of the Atomic Scientists, Vol 26, No 3, p 17-23, March 1970. 5 fig.

Descriptors: *Thermal pollution, Radioactiv wastes, *Nuclear wastes, Water law, *Powerplants Aquatic plants, Lake Michigan, Heat transfer Seasonal, *Water pollution effects.
Identifiers: Maximum possible concentration.

In the Chicago metropolitan area, the Common wealth Edison Company is building new nuclea power plants to provide badly needed additiona generating capacity. Fear of radioactive discharge and thermal pollution has provoked two lawsuits seeking injunctions to restrain the utility from discharging heated, effluent water and radioactive material from a 2,200,000 kilowatt, two uni nuclear power plant at Zion, Illinois into Lak Michigan. One of the sawsuits has been brought by the Metropolitan Sanitary District of Greate Chicago. It asserts that condenser-heated lak water will 'radically raise the temperature of sub stantial parts of the waters of the lake and caus thermal pollution, severely and deleteriously af fecting the ecology of the lake.' A second suit con tends that three billion gallons of lake water a da would be heated 18 to 20 degrees Fahrenheit abov ambient lake temperature. Its discharge back int the lake would increase the toxicity of existing pol lutants, stimulate the growth of aquatic plan nuisances and speed up the deterioration of Lak Michigan. The suits cite the threat of radioactiv pollutants in the lake, the principal source o domestic water in a region of eight million people The author concludes that the amount of nuclea power to be installed by 1975 gives no cause fo concern about thermal or radioactive pollution Further work is needed to ascertain effects of con tinued installation of power plants along Lak Michigan. (Osborne-Vanderbilt)
W70-08130

COOLING RESERVOIR STUDY,
J. D. Calbert.
Power Engineering, Vol 71, No 12, p 52-53, De 1967. 1 fig, 1 tab.

Descriptors: *Cooling water, Feasibility studies *Water temperature, *Computer programs, Mode studies, Energy budget, Air temperature, Stream flow, Water rights.
Identifiers: *Square Butte Creek, Cooling reser voir.

Low-cost energy from lignite was to be available i early 1970 from Minnkota's new 121-Mw plant a Center, N.D. In determining the feasibility of thi project, Minnkota engineers assessed Square Butt Creek, flowing through the lignite fields, as potential water supply. The results favored con struction of an economic dam and reservoir. Th fundamental considerations in the planning an design of the cooling reservoir were assessed by comprehensive computer program. An energ budget analysis involving a relationship betwee degrees of cooling required and net heat loss pe unit of cooling pond area was used along with great deal of meteorological and streamflow data Further, the data was based on the critical condi tions along Square Butte Creek during 1960 an 1961. The results showed that the initial 212-Mw steam unit could operate on the proposed reservoi without make-up water beyond natural flow. Thi paper contains a table of the actual computer read out for the 31 days in July 1961 (the most critica time period) showing what the operating condi tions would have been. About 2 acres of water sur face per megawatt were required. (Osborne-Van derbilt)
W70-08132

D. Waste Treatment Processes

IE INCINERATION OF SOLID AND LIQUID ASTE AT FABENFABRIKEN BAYER,
orst W. Fabian.
oceedings of the Industrial Waste Conference, rd, 1968, p 874-882. 6 fig.

escriptors: *Incineration, *Industrial wastes, olid wastes, *Liquid wastes, *Costs, *Air pollun, *Gases, Chlorine, Heat exchangers.
entifiers: *Chlorine wastes, Afterburners, Rotary n.

the 500,000 cubic meters of wastes produced nually at the Leverkusen Works of Farnfabriken Bayer, 40,000 metric tons of solid, sty, and liquid wastes can be incinerated. An inerator plant, built in 1967 at a cost of 18 million marks disposes of these wastes at a cost of 80-0 D-marks per metric ton. Incineration of most stes occurs in a rotary kiln 12 meters by 3 mers, with detention times of 30-60 minutes at a mperature of 1200 deg C. Solid wastes are duced 90% by volume, and 70% by weight. aste gases (60,000-70,000 Nm3/hr) are sent rough a system of afterburners at 1200 deg C and en to a series of heat exchangers before discharge rough a 100 meter stack. Up to 25 metric tons of eam are recovered per hour at 400 deg C and 40 /sq cm. Wastes with chlorine are burned in other flame tube and the waste gases are treated parately in a water scrubber which has an effiency of 95% and reduces the waste gas to less an 1000mg/Hm3HCl, the upper limit specified by e authorities. Upon completion of a sewage treatent plant, another 150,000 cubic meters of sludge ll be incinerated at this plant each year. (Makelexas)
70-07707

ODEL STUDY OF COLLOID REMOVAL,
innesota Univ., Minneapolis.
alter J. Maier.
urnal of the Water Pollution Control Federation, ol 40, No 3, Part 1, p 478-491, March 1968. 8 fig, tab, 16 ref.

escriptors: *Biological treatment, *Colloids, Thin ms, *Waste water treatment, Efficiencies, Slime, ctivated sludge, Concentration (Composition), osts, *Enzymes, Trickling filter.
entifiers: *Starch.

ological treatment of colloidal starch solutions is scribed in terms of a sequence of steps any one of nich may be rate controlling: (1) mass transfer of bstrate from bulk liquid phase to cell or active nzyme site, (2) degradation of colloidal particles to smaller fragments to facilitate passage through e semi-permeable membrane of metabolising cteria cells, (3) metabolism of the substrate parcles within the cells to provide energy and buildg blocks for growth. Experimental results of two pes of reactors are described using starch as a presentative colloid. Results from process variae studies show that mass trasfer is the rate conolling factor in a laminar film flow reactor which nulates trickling filter conditions. On the other nd, high rates of mass transfer are obtained in a ell mixed reaction vessel simulating activated udge conditions due to eddy current transport. ydrolytic degradation of colloid starch into small oluble carbohydrates proceeds rapidly and does ot appear to be rate limiting in either type of reacon. Hydrolysis is mediated by enzymes which are vailable outside the confines of the semi-permeae cell membranes. Enzyme activity was observed cell-free filtrates thus indicating some presence free enzymes in solution. It is theorized that it ould be possible to improve the efficiency of ickling filters by increasing the mass transfer. This ould be accomplished by improved packing design nd/or agitation. (Hancuff-Texas)
70-07708

BIOLOGICAL TREATMENT OF MIXTURES OF TEXTILE WASTES AND DOMESTIC SEWAGE,
Cone Mills Corp., Greensboro, N.C.
R. H. Souther, and T. A. Alspaugh.
Sewage and Industrial Wastes, Vol 28, p 166-176, 1956. 13 tab, 1 fig, 14 ref.

Descriptors: *Sewage, *Trickling filters, Pilot plants, Alkalinity, Sedimentation, Filtration, Activated sludge, Domestic wastes, *Biological treatment, Waste water treatment.
Identifiers: *Textile mill wastes.

Experiments were made on a mixture of sewage and highly alkaline textile mill waste waters to compare the efficiency of three different methods of treatment, these methods being (1) two-stage sedimentation and high-rate biological filtration, (2) single-stage high-rate filtration followed by the activated-sludge process, and (3) a two-stage high-rate filtration followed by the activated sludge process. A mixture of 40% of the waste water and 60% sewage was applied at rates of 125, 150, 210 and 250 gal/day. Filters were 1.25 feet in diameter. The results showed that method 2 gives an effluent suitable for discharge to a small stream, the reduction in BOD varying from 78% at a rate of flow of 125 gal/day to 66% at a rate of 250 gal/day. Except at a rate of flow of 125 gal/day with a recirculation ratio of 2:1, two-stage filtration and final sedimentation alone did not give as satisfactory effluent as method 2. Method 3 gave excellent results, with reductions in BOD varying from 97.4% at a rate of 250 gal/day. It is planned to continue the study. (Work-North Carolina State)
W70-07709

WASTEWATER TREATMENT PLANT DESIGN EXPERIENCE AT VANCOUVER, BRITISH COLUMBIA,
Greater Vancouver Sewage and Drainage District (British Columbia).
D. G. Devlin.
Journal of the Water Pollution Control Federation, Vol 40, No 3, p 468-477, March 1968. 3 fig, 2 tab.

Descriptors: *Waste water treatment, *Sewage treatment, Design, Digestion, Chlorination, Sludge Operation and Maintenance.
Identifiers: *Primary treatment, Vancouver (British Columbia).

A discussion of problems and solutions is presented for operation of two primary waste water treatment plants in the Vancouver district for the Lion's Gate treatment plant and Iona Island Plant. The Lion's Gate treatment plant consists of prechlorination, communution, preaeration, grit removal, sedimentation, post-chlorination, and sludge digestion with use of digester gas in boilers and engines. The first problem experienced was that of infiltration into the interceptor sewers; the sources are being sought out and eliminated. The practice of discharging septic tank pump trucks directly to the influent had to be discontinued due to the shock loading effects. The solution, direct transfer to the digesters had to be discontinued due to the restrictions on the quantity of digested sludge permitted to be discharged to the Strait of Georgia. Some difficulties experienced in sampling the influent and effluent are presented. Experiences at the Iona Island treatment plant are enumerated much along the same lines. In spite of these problems, the plants are said to have generally functioned well. (Hancuff-Texas)
W70-07710

DESIGN OF THE NEWTOWN CREEK WATER POLLUTION CONTROL PROJECT,
Department of Water Resources, New York. Bureau of Water Pollution Control.
Joseph Cunetta, and Robert Feuer.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 643-658, April 1968. 2 fig, 11 tab.

Descriptors: *Waste water treatment, *Design, *Costs, Activated sludge, Sewage treatment, Pollution abatement, Aeration, Digestion, Screens, Sludge, New York.
Identifiers: Newtown Creek (New York), Parameters, Barging.

The intercepting sewer system for the Newtown Creek project serves portions of the burroughs of Manhattan, Brooklyn, and Queens, and collects from a drainage area of 15,389 acres. The Newtown Creek treatment plant utilizes high-rate activated sludge process, and has a design capacity of 310 mgd from an estimated equivalent population of 2,500,000. Included in the report is a description of the area and population served, the waste water treated, methods of conveyance, receiving water ways, plant site, and treatment units used. The dimensions, capacities, areas, loadings, removal capabilities, volumes, operating conditions, detention times and other parameters are tabulated for each unit process. The facility includes grit chambers, aeration tanks, sedimentation tanks, digesters, and the facilities for hypochlorination of plant effluent. The high rate activated sludge process is designed to achieve removals of 70% of the suspended solids and 60% of the BOD, both of which are estimated at 200 mg/l influent. A high-rate digestion is provided for the sludge prior to barging to sea. When completed, the Newtown Creek Water Pollution Control project will have cost approximately $167,000,000. (Hancuff-Texas)
W70-07711

APPLICATION OF COMPLETELY MIXED ACTIVATED SLUDGE DESIGN EQUATIONS TO INDUSTRIAL WASTES,
Kansas Univ., Lawrence.
Carl E. Burkhead, and Ross E. McKinney.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 557-570, April 1968. 13 fig, 7 tab, 7 ref.

Descriptors: *Activated sludge, *Mathematical model, *Industrial waste, Degradation (Decomposition), Waste water treatment, Design, Biochemical oxygen demand, Chemical oxygen demand, Energy, Mixing.
Identifiers: *Warburg.

A total of 19 separate Warburg runs were made on 15 different substrates. The oxygen uptake curves show the energy utilized during synthesis and endogenous respiration. The soluble COD curves illustrate the rate of removal of the substrate, while the insoluble COD curves show the incorporation of insoluble substrate into microbial mass. The most important aspect of the McKinney equations was considered in the analysis of this data: the basic energy synthesis relationship. It had previously shown for domestic sewage that in terms of the oxygen equivalents of biodegradable substrate that 1/3 of the substrate's total oxygen demand would be used for energy while 2/3 of the total oxygen demand would be converted into microbial protoplasm. This relationship was shown to be valid only for domestic sewage. The energy-synthesis proportionality constant K1 equals 0.50 for domestic sewage. However, new constants which are dependent on the nature of the waste have been measured. They are 0.33 for carbohydrates and 0.92 for non-carbohydrates. Other less substantiated K1 values are 0.92 and 0.71 for amino and fatty acids respectively. Use of data for design is discussed step by step and a sample program is presented. (Hancuff-Texas)
W70-07712

START-UP OF NEW WASTE WATER TREATMENT PLANTS,
Ontario Water Resources Commission, Toronto.
D. S. Caverly.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 571-580, April 1968.

Descriptors: *Waste water treatment, *Sewage treatment, *Operation and maintenance, Digesters, Aeration, Chlorination, Education, Plants, Activated sludge.
Identifiers: *Start-up, *Check-out, *Routine, *Procedures.

The Ontario Water Resources Commission has developed a program of start-up procedures coupled with operator training that has proven beneficial in the commission's operations. The start-up procedures have been developed over a period of years with the operation of 93 waste water treatment plants as the guide. The start-up procedure consists of 4 days of intensive check-out followed by a series of inspections which last over a period of weeks. The first day is the most comprehensive including study of the blue prints with the plant operator and a full general explanation of each unit process. Before any waste water is permitted to flow into the plant, units must be inspected carefully during the dry check-out. The steps include inspection of the influent works, primary tanks, aeration tanks, digesters, and general overall mechanical equipment. For the wet check-out procedures are given for investigating the mechanical operations of the previously listed unit processes. Two detailed methods are given for the development of suspended solids in the mixed liquor. Of extreme importance in the start-up of a plant is acquainting the operator with the plant and the procedures he must follow to operate it properly. (Hancuff-Texas)
W70-07713

CLOSED LOOP CHLORINATION FOR WASTE WATERS,
Metcalf and Eddy, Inc., Boston, Mass.
Ariel A. Thomas, and Walter H. Brown.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 684-688, April 1968. 2 fig.

Descriptors: *Chlorination, *Automatic control, Waste water treatment, Costs, Design, Equipment, Chlorine, Coliforms.
Identifiers: *Closed loop chlorination, Dosage, Residual.

Closed loop chlorination provides a relatively inexpensive method by which all treatment plants can provide effective chlorination. Hardware to provide chlorination control by flow has been available and in satisfactory use for many years. It costs approximately $5,000 and requires maintenance as does any instrumentation equipment. These instruments can replace four men required to measure chlorine residuals around the clock and actually compute continuous chlorine residuals which can be recorded. The information from chlorine residual instruments can be returned to controls which change the rate of chlorine feed to the waste water. This system of continually determining chlorine residual and continually adjusting the rate of chlorine feed to get a predetermined chlorine residual is called closed loop chlorination. The loop is formed by feeding back upstream control information. The future efficiency of treatment expected will make accurate manual control almost impossible, leaving closed loop chlorination the answer for economical and effective chlorination of treated and untreated waste waters. (Hancuff-Texas)
W70-07714

AIR TESTING SANITARY SEWERS,
Bloomington, Minn.; and Cherne Industrial, Inc., Hopkins, Minn.
Sam H. Hobbs, and Lloyd G. Cherne.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 636-642, April 1968. 10 fig, 1 tab.

Descriptors: *Sewers, *Testing, *Leakage, Pressure, Infiltration, Joints (Connections), Costs, Construction.
Identifiers: Television, Bloomington, Minnesota.

A test of every sewer line after construction is imperative. In the past, two types of accepted testing have been required: (1) a ball must be flushed through every section of the sewer pipe to insure against major structural failures, (2) infiltration or exfiltration tests must be made. The infiltration test consists of plugging the upper end section of a sewer and measuring the flow at the lower end. The exfiltration is performed by plugging the lower end and measuring the flow required to maintain a level of 4 foot head. The present specifications permit leakage (infiltration or exfiltration) not to exceed 3.2 gallons per hour/100 ft of sewer. Air pressure loss was tested and found to correlate with exfiltration. A good straight-line correlation was found in clay pipe; however, no definite correlation applicable to all materials could be determined. For the clay pipe 1 psi pressure was almost equivalent to the exfiltration specification of 3.2 gallons per hour/100 ft. When attempting to locate severe leakage test plugs with a short length of cable and testing line are pulled through the sewer. These are spaced at 22 inch centers, pulled into position, inflated, pressure built up, tests made, and the plugs deflated and moved to the next position. Television inspection of several sewer line sections confirmed the results of air testing data. (Hancuff-Texas)
W70-07715

KINETICS OF MODEL AND FIELD EXTENDED-AERATION WASTE WATER TREATMENT UNITS,
Mississippi State Univ., State College.
E. Joe Middlebrooks, and C. F. Garland.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 586-612, April 1968. 27 fig, 5 tab, 59 ref.

Descriptors: *Activated sludge, *Kinetics, *Mathematical model, *Sewage treatment, Growth rate, Efficiency, Waste water treatment, Microorganisms, Prototypes.
Identifiers: *Extended aeration, Sludge volume index, Parameters.

Mathematical models were found to simulate the performance of actual field installations. Raw waste water was used as an influent substrate in the continuous flow model studies and its performance was found to be superior to that obtained with synthetic wastes. Non-flocculant solids appear to effect the periodic solids losses in the effluent as much as de-nitrification or hydraulic loading variations. The data collected from laboratory units using raw waste water to obtain design parameters are said to be applicable when determining the required mixed liquor suspended solids and the oxygen uptake rate for a given prototype system. Operation at a high suspended solids level will increase variation in the effluent quality. The laboratory units showed that the specific organism decay rate increases with influent substrate concentration. (Hancuff-Texas)
W70-07716

PHOTOCHEMICAL DEGRADATION OF REFRACTORY ORGANIC COMPOUNDS,
Washington Univ., St. Louis.
Charles D. Bulla, III, and E. Edgerley, Jr.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 546-556, April 1968. 5 fig, 2 tab, 7 ref.

Descriptors: *Ultraviolet radiation, *Organics, *Degradation (Decomposition), Waste water treatment, Adsorption, Toxicity, Pesticides, Irradiation, Electromagnetic waves, Aldrin, Dieldred, Endrin.
Identifiers: *Photochemistry.

Photochemical reactions are initated by the absorbance of electromagnetic radiation energy by an atom or molecule. This process elevates the absorbing species to a higher energy level usually causing the species to become unstable and through a deactivation process revert to a lower less energetic and more stable state. Investigation of the photochemical degradation of aldrin, dieldren, and endrin, in dilute aqueous solutions are made. All three compounds are subject to photochemical degradation by 2537A deg. electromagnetic radiations. Process variables; time, depth, and power may be related to the degradation rate of any one of the compounds studied by a convenient mathematical model. Temperature was shown to have no influence between the range of 20 deg. and 40 deg. C. A bioassay of blue gills showed that the irradiated aldrin was less toxic than pure aldrin itself. Cost estimates for 50% degradation of pesticides at a 10 cm depth are given as $24.50/10 to the 6th gal. for aldrin; $73.00/10 to the 6th gal. for dieldren; $57.50/10 to the 6th gal for endrin. (Hancuff-Texas)
W70-07717

ENERGY INDUCED CHANGES IN AN AZO DYESTUFF,
AeroChem Research Labs., Inc., Princeton, N.J. and Rutgers - The State Univ., New Brunswick, N.J.
Alan I. Mytelka, and Raymond Manganelli.
Journal of the Water Pollution Control Federation, Vol 40, No 2, Part 1, p 260-268, April 1968. 8 fig, 2 tab, 20 ref.

Descriptors: *Irradiation, *Cobalt radioisotopes, *Industrial waste, *Waste water treatment, Hydrogen ion concentration, Dissolved oxygen, Biochemical oxygen demand, Gamma rays.
Identifiers: *Dyestuff, *Ionizing, Chemical oxidation, Luminants, Sterilization, Solids.

A study of Color Index Direct Red 79 is made to determine the changes in properties after irradiation. The experimental conditions under which the irradiation took place were waste dilution of approximately 100:1, pH of 12.1 and a dose rate of 0.17 megarads/hour. Gas was bubbled through the waste at 40% oxygen and 60% nitrogen. After the absorption of 2.6 megarads, the COD was reduced 61%, TOC decreased 43% and for all practical purposes none of the dye remained. The ionizing radiation source was Cobalt 60 gamma radiation. The effect of ionizing radiation on the biodegradability was also studied. Increasing the dose improved the biodegradability of the waste from an initial value of 9 mg/l of oxygen uptake (5-day Warburg) with no irradiation, to 85 mg/l oxygen uptake with 2.5 megarads of irradiation. At the same doses the COD:BOD ratio decreased from 54.0 to 2.2. The latter figure is significant since it is approximately the same as domestic sewage. (Hancuff-Texas)
W70-07718

STUDY OF WASTE WATER FROM DYEWORKS (IN FRENCH),
E. Leclerc.
Bulletin du Centre Belge d'Etude et de Documentation des Eaux, No 23, p 39-51, 1954.

Descriptors: *Cotton, *Waste water treatment, *Sedimentation, *Pollution abatement, Biological oxygen demand, Solid wastes, Fish conservation.
Identifiers: *Dyehouse wastes, *Linen, Waste water analysis, Sizing wastes, Bleaching waste, Desizing, Textile mill wastes.

The characteristics of the various types of waste waters from the textile industry are described and methods of treatment are reviewed. Preliminary studies of the waste waters for works engaged in the bleaching and sizing of cotton and linen are reported. The effluent is settled in fiber sedimentation tanks in series before discharge at a rate of 550 cu m/hr to the river Lys. Analysis of samples taken from the spillway to the river revealed no significant variations in the character of the effluent. During the day the effluent satisfies the condensation for discharge to a third-class (industrial) river in every way except that the amount of settleable solids slightly exceeds the limit. The waste waters become reoxygenated in the first sedimentation tank. Sedimentation reduces the BOD of the waste waters from 270 mg to 111 mg/liter. The BOD of the river water is increased by 20% by the discharge of the effluent; it is already heavily polluted at this point by other trade waste waters. (Livengood-North Carolina State)
W70-07720

WASTE WATER REUSE,
New York State Department of Health, Albany.
Donald B. Stevens.

urnal of the Water Pollution Control Federation, ol 40, No 4, p 677-683, April 1968. 2 fig, 1 tab, ref.

escriptors: *Water reuse, *Tertiary treatment, aste water treatment, Groundwater, Recharge lls, Injection wells.

hile New York State is a comparatively water h state it must provide a high degree of treatnt to its waste water simply because every eam is a source of water supply. The present te of the art is such that a water meeting drinking ter standards can be produced from the usual n of domestic waste waters. Emphasis must shift m the mere removal of pollutants from the mainam of waste water to satisfactory disposal of s removal material. Two current studies are scribed in regard to the replenishment of groundter well supplies. It is estimated that by the year 77, the groundwater supply will be exceeded by e demand and rain alone will not be able to plenish the source. Plain I (Nassau County) is to gment the groundwater supply and simultanesly provide a hydraulic barrier to prevent salt ter intrusion. Plan II (Long Island) provides for rtiary treatment which will produce an effluent at meets the drinking water standards. The cond plan is also to be used for groundwater intion. (Hancuff-Texas)
70-07721

EW PROCESS TO REMOVE PHENOLS FROM ASTE WATER,
umble Oil and Refining Co., Houston, Tex.
illiam L. Lewis.
urnal of the Water Pollution Control Federation, ol 40, No 5, Part I, p 869-872, May 1968. 3 fig.

escriptors: *Phenols, *Recovery, *Emulsions, Instrial waste, Waste water treatment, Costs, Oil, ochemical oxygen demand, Distillation.
entifiers: *Extraction, Catalytic cracking, ydrocarbons.

process to extract phenols from catalytic acking distillate water recently was developed by umble Oil and Refining Company. With a 12- x 0-ft electrostatic treating drum, this extraction chnique can reduce the phenol content of catacker distillate water up to 90%. The water eated, condensate distillate water, usually conins more than 300 mg/l of phenols. Because of e volume of condensate water normally is 5 to 5% of the hydrocarbon distillate volume, the total henols in the effluent water stream can amount to veral hundred pounds per day. By thoroughly ixing the distillate water with cycle oil and then lowing the emulsion to separate, the phenol partions itself between the two emiscible liquids with ost of it transfering to the hydrocarbon phase. his transfer is enhanced by a stimulated random otion of water particles brought about by a 0,000- to 40,000-volt potential. The installed cost f the device was less than $200,000. (Hancuff-exas)
70-07722

RAINING SANITARY ENGINEERING ECHNICIANS AT FAYETTEVILLE TECHNIAL INSTITUTE,
ayetteville Technical Inst., N.C.
oward E. Boudreau, and Charles A. Purcell, Jr.
ournal of the Water Pollution Control Federation, ol 40, No 5, p 857-864, May 1968.

escriptors: *Training, *Personnel, *Sanitary enneering, Education, Schools (Education).
dentifiers: *Operators, *Technicians, Technical chool, Fayetteville, North Carolina.

two-year program leading to the Associate of pplied Science degree in Sanitary Engineering echnology has been established at Fayetteville echnical Institute in North Carolina. The curricuum includes: mathematics, physics, chemistry, iology, fundamental of water and waste treatment, drafting and surveying among its technical courses and also provides training in written and oral expression, economics, and psychology. An integral part of most of the technical courses is the laboratory work. Demand for graduates of the program has been high. (Hancuff-Texas)
W70-07723

LAND RECLAMATION--A COMPLETE SOLUTION OF THE SLUDGE AND SOLIDS DISPOSAL PROBLEM,
Metropolitan Sanitary District of Greater Chicago, Ill.
Frank E. Dalton, Jerome E. Stein, and Bart T. Lynam.
Journal of the Water Pollution Control Federation, Vol 40, No 5, p 789-804, May 1968. 14 fig.

Descriptors: *Sludge disposal, *Land reclamation, Sludge, Activated sludge, Costs, Fertilizers, Lagoons, Nitrogen, Phosphorus, Research and development, Illinois.
Identifiers: Wet air oxidation, Chicago (Ill), Solids.

The West-Southwest plant of Chicago handles approximately 825 tons/day of solids. In order to handle this load 4 methods are used: (1) heat dried activated sludge producing approximately 435 tons/day, (2) wet air oxidation process approximately 145 tons/day, (3) heated digesters, 100 tons/day, and (4) Imhoff tank sludge 145 tons/day. To this should be added 90 tons/day from the Calumet plant making a total of over 900 tons/day of sludge on a dry basis. The solids disposal cost is approximately 14.5 million dollars per year, or 46% of the annual maintenance and operation budget. A proposed land reclamation plan satisfying the following criteria is reviewed. (1) It must meet environmental standards, no air or water pollution, (2) it must solve the problem into perpetuity, (3) the method should be economical, and (4) the organic matter should be conserved for beneficial use. Implementation of the reclamation plant requires research and careful planning. Of special interest is that portion of the plan for liquid as well as solid disposal. Some areas utilizing waste for land reclamation are documented. (Hancuff-Texas)
W70-07724

DESIGNS OF A MODERN MEAT PACKING WASTE TREATMENT PLANT,
Giffels and Rossetti, Inc., Detroit, Mich.; and Florida State Board of Health, Jacksonville.
E. Willoughby, and V. D. Patton.
Journal of the Water Pollution Control Federation, Vol 40, No 1, p 132-137, Jan 1968.

Descriptors: *Industrial waste, *Waste water treatment, *Design, Operation and maintenance, Costs, Activated sludge.
Identifiers: *Meat packing, Loading.

A brief description is given of the in-plant actions taken to eliminate the sources of pollution through their reclamation. For example, all the viscera, horns, hooves, and other inedibles were hashed and cooked, and the grease reclaimed. The process chosen for the unreclaimable portion of the wastes was extended aeration modification of activated sludge. The basic components of the system as designed and installed include a sedimentation and grease skimming facility, extended aeration, and aerobic digestion. The aerobic digestion system consists of two aeration tanks and an aerobic tank, final settling tank, with an air-lift sludge return system, 5-acre aerobic stabilization pond, multistage air compressor facility, chlorination facility, and detention pond. Testing of composite samples over a month period indicated that: (1) the biological load was about equal to the design load of 2,000 lbs. BOD per day, (2) the hydraulic load was about 160% of the design basis of 315,000 bal/day, (3) BOD removal averaged 95%, (4) suspended solids removal averaged 84%, (5) Settleable solids removal averaged 98%, (6) grease removal averaged 98%. Total cost of the facility was about $250,000. (Hancuff-Texas)
W70-07725

HYDRAULIC MODEL STUDIES OF CHLORINE MIXING AND CONTACT CHAMBERS,
Harza Engineering Co., Chicago, Ill.
David S. Louie, and Martin S. Fohrman.
Journal of the Water Pollution Control Federation, Vol 40, No 2, Part 1, p 174-184, Feb 1968. 6 fig, 3 tab.

Descriptors: *Chlorination, *Model studies, Mixing, Design, Flow profiles, Head loss, Baffles, Costs.
Identifiers: Diffusers, Detention time.

Because of the size and cost of the proposed postchlorination facility for Metropolitan Sanitary District of Greater Chicago (330 MGD) it was decided that an extensive model study would be desirable. The scale finally decided upon was 1 to 10, and because of the physical largeness of the model, results were considered to be more reliable than usually could be extrapolated from a model to prototype. Since the prototype was to consist of two symmetrical batteries it was necessary to model only one half of the prototype. Confetti and dye were used for visual observation of mixing in the mixing chamber and distribution of flow in the contact chamber. Five basic contact chamber schemes were tested for their comparative performances from the standpoint of flow patterns, head loss, and detention time. The results of the study on the mixing chamber and diffuser system provided an effective means of evaluating the methods of introducing and mixing chlorine with the plant effluent. The most efficient design for the contact chamber was a van-baffle system. The scheme was superior for the following reasons. (1) It had lowest head loss of all the schemes studied. (2) It had the highest minimum and mean detention time. (3) It was the most desirable of all schemes as regards sedimentation because of a more uniform flow pattern. (Hancuff-Texas)
W70-07726

FLOCCULATION OF BULKED ACTIVATED SLUDGE WITH POLYELECTROLYTES,
Northwestern Univ., Evanston, Ill.
Phillip C. Singer, Wesley O. Pipes, and Edward R. Hermann.
Journal of the Water Pollution Control Federation, Vol 40, No 2, Part 2, p R1-R9, Feb 1968.

Descriptors: *Activated sludge, *Flocculation, *Sphaerotilus, Sludge, Coagulation, Costs, Sewage treatment, Electrolytes.
Identifiers: *Bulking, *Polymer, Settling.

Bulk sludge can be flocculated and certain cationic polyelectrolytes are flocculants of bulk activated sludge. The optimum concentration for the two cationic polymers studied were found to depend on the initial sludge volume index and on the suspended solids content. The greater the suspended solids concentration, the greater was the polymer requirement, and the greater the final settled volume. As more polymer is added beyond the point of maximum flocculation, the floc becomes larger resulting in greater settled volume due to trapped water. The use of cationic polymers in flocculated bulk sludge resulted in the discharge of a clear stable effluent at dosages of between 2 and 3 mg/l. However, it was also found to be successful at a dosage of 50 mg/l. The treatment costs were: alum, $9.40/million gallons; cationic polymer A, $6.50/million gallons; cationic polymer B, $20.00/million gallons. Sludge once coagulated by a polymer seemed resistant to subsequent polymer coagulation during experiments of recycling of sludge. (Hancuff-Texas)
W70-07727

THE BIODEGRADABILITY AND TREATABILITY OF NTA,
Proctor and Gamble Co., Cincinnati, Ohio.
J. E. Thompson, and J. R. Duthie.

Journal of the Water Pollution Control Federation, Vol 40, No 2, Part 1, p 306-319, Feb 1968. 10 fig, 2 tab, 15 ref.

Descriptors: *Biodegradation, *Detergents, Activated sludge, Waste water treatment, Sewage treatment, *Laboratory tests, Degradation (Decomposition), Surfactants.
Identifiers: Trisodium nitrilo triacetate (NTA), Laboratory scale.

The use of NTA in combination with polyphosphates has been found to be effective as a detergent builder. As an ingredient in detergents, NTA becomes a component of waste water and therefore the biodegradability and treatability of NTA are of interest to the detergent industry and to others concerned with waste water treatment and water supply. The results of this study show that NTA is metabolised to carbon dioxide, water, and inorganic nitrogen by microorganisms present in waste water and river water; thus NTA is biodegradable. The biodegradation process is suggested as an initial cleavage and immediate metabolism of two acetate groups followed by metabolism of the glycine fragment. Measurements of oxygen utilization by microorganisms metabolising NTA indicate that carbonaceous oxygen demand was 59% of theoretical in 5 days, and 91% in 13 to 20 days. The rate and extent of NTA degradation was found to be comparable to those of glucose and citric acid. It was found to be removed from waste water by the activated sludge process, have no effect on primary and secondary settling, nor on sludge digestion, and would degrade rapidly when entering rivers or lakes. A zinc-zincon analytical method for the detection of NTA is presented in an appendix. (Hancuff-Texas)
W70-07728

SUBSTRATE UTILIZATION AND HIGH BIOLOGICAL SOLIDS CONCENTRATION,
Oklahoma State Univ., Stillwater.
P. Krishnan, and A. F. Gaudy, Jr.
Journal of the Water Pollution Control Federation, Vol 40, No 2, Part 2, p R54-R66, Feb 1968. 8 fig, 1 tab, 23 ref.

Descriptors: *Activated sludge, *Concentration (Composition), *Kinetics, *Degradation (Decomposition), Sewage treatment, Waste water treatment, Chemical oxygen demand, Adsorption, Carbohydrates, Sludge, Protein, Microorganisms, Metabolism.
Identifiers: *Biological solids, Warburg.

Laboratory-scale studies of batch activated sludge units with glucose and sorbitol as carbon sources showed that no relation existed between immediate uptake and initial solids concentration, for concentrations of 1,500 to 4,700 mg/l. It was observed in making studies with sorbitol and glucose and other studies in the laboratory, that during substrate removal using relatively high initial biological solids, most of the substrate is channeled into carbohydrate synthesis and that after this, protein is synthesized from the carbohydrate store, i.e., the two syntheses are observed to occur in essentially a sequential manner. The ability of high solids systems to remove substrate in the complete absence of protein synthesis is rigorously demonstrated by the experiment using chloramaphenicol. The results of the sorbitol experiments throw a particular light on the question of adsorption as a primary mechanism of substrate removal. No evidence for adsorption could be found, but additional evidence for the purely biochemical mechanism is put forth. (Hancuff-Texas)
W70-07729

TECHNOLOGY AND ECONOMICS OF SEWAGE TREATMENT (IN GERMAN),
For primary bibliographic entry see Field 05A.
W70-07730

EFFECTS OF AMINO ACIDS ON ANAEROBIC DIGESTION,
Texas Univ., Austin.
Ernest M. Miholits, and Joseph F. Malina, Jr.
Journal of the Water Pollution Control Federation, Vol 40, No 2, Part 2, p R 42-53, Feb 1968.

Descriptors: *Anaerobic digestion, *Amino acids, Digestion, Biomass, Waste water treatment.
Identifiers: *Warburg analysis, *Radioactive tracers, Substrate, Labelled, Removal, Laboratory scale.

In this study single non-radioactive amino acids, as well as labelled 1-C-14 amino acids were added to digested starch, and the effects of this compound on quantity and quality of gas production were recorded. Laboratory scale digestion units and manometric techniques were used in these studies. The results show that micromole quantities of leucine, methionine, alanine, glycine stimulate gaseous production of an anaerobic system. Normal parameters, pH, alkalinity, and volatile acid concentrations, all of which are rough parameters which tell nothing of the variations occurring in the microbial population in localized portions of the digester may fail to indicate actual performance, while amino acid concentration and gas production values may be more meaningful. (Hancuff-Texas)
W70-07731

USE OF COMPUTERS IN DESIGN OF SANITARY SEWER SYSTEMS,
Polytechnic Inst. of Brooklyn, N.Y.
P. R. DeCicco, H. F. Soehngen, and J. Takagi.
Journal of the Water Pollution Control Federation, Vol 40, No 2, Part 1, p 269-284, Feb 1968. 15 fig.

Descriptors: *Design, *Sewers, *Computers, Systems analysis, Data processing, Flow, Programs, Costs, Evaluation, Analysis.

The electronic computer techniques developed for the design of municipal sanitary waste water collection systems include linked programs for estimation of design flow, design of sewers, computation of partial flow characteristics, and estimate of costs. The system recently was applied to the design of Merrick Harbor Collection District system in Nassau County, New York, which has an area of about 5 sq.mi. and an ultimate population of 39,500. The programs are applicable to any area, regardless of size, topography, configuration, or other special characteristics. Inputs include basis for estimating design flows, sewer design criteria, demographic, topographic and geologic data and sewer layout requirements. The program also accepts information about potential obstructions and locates sewers to avoid interference. The computerized procedure improved both quality and quantity of output and released engineering personnel from routine computations. (Hancuff-Texas)
W70-07732

OPTIMIZATION OF THE HYDRAULIC REGIME OF ACTIVATED SLUDGE SYSTEMS,
Kansas State Univ., Manhattan.
Larry E. Erickson, and Liang-tseng Fan.
Journal of the Water Pollution Control Federation, Vol 40, No 3, p 345-362, March 1968. 14 fig, 3 tab, 22 ref. OWRR B-001-KAN.

Descriptors: *Activated sludge, *Mathematical model, *Hydraulics, *Optimization, Biological treatment, Sewage treatment, Costs, Economics, Waste water treatment, Aeration, Concentration (Composition), Efficiency.

The systems approach is taken to simulate and mathematically optimize a combination of process and economic models for activated sludge. Mathematical models are given for the growth kinetics of biological systems, hydraulics of completely mixed tanks in series, and economic considerations as capital and operating costs. A combination of the kinetic, hydraulic, and economic models is made and approached from a minimum cost standpoint. Several tables are presented giving design constants for various biological k rates for systems with 90 and 99% treatment. Mathematical optimization techniques can be used to obtain useful information about the activated sludge system. K1 a dimensionless organic nutrient concentration at which the specific growth rate is one half the maximum value is a very important variable in the design of an activated sludge system. The optimum allocation of volumes for two aeration tank activated sludge systems changes significantly with changes in K1. Results of analyses of completely mixed aeration tanks show that the theoretical volume requirement for an optimal 2 aeration tank activated sludge system is less than for a system of a single aeration tank. (Hancuff-Texas)
W70-07733

TECHNIQUES AND FACTORS INVOLVED IN AERATOR SELECTION AND EVALUATION,
Dow Chemical Co., Midland, Mich.
Rudy G. Novak.
Journal of the Water Pollution Control Federation, Vol 40, No 3, Part 1, p 452-463, March 1968. 11 fig, 2 tab.

Descriptors: *Oxygenation, *Aeration, *Equipment, Efficiency, BOD, Design, Industrial waste, Waste water treatment, Oxygen, Sewage treatment.
Identifiers: *Oxygen transfer, Mechanical aerators, Power, Uptake rate.

Oxygenating efficiencies of aerators measured during steady-state operation are not accurate enough to determine compliance with performance guarantee. Oxygenating efficiencies measured during steady-state operation are better indicators of relative performance than absolute performance. The absolute oxygenating efficiency of an aerator can be measured best by a study of individual aerator oxygenation performance under non-steady state operation in a basin sized to permit accurate determination of the required data. Two different types of aeration equipment were studied: a mechanical propellor-type mixer, and an ejection aeration system. Results from the mechanical aerator study showed that transfer under standard conditions was 4.1 lb O2/HP-hr and evaluation of the ejector showed a value of 4.3 lb O2/HP-hr. Oxygen uptake rates were determined by plotting Cs-C1 versus time for mixed liquor and pure water. From these KLA values were determined. Other parameters evaluated include chemical oxygen demand, biochemical oxygen demand, sludge volume index, suspended solids and mixed liquor velocity. Factors which must be considered in aerator evaluation were said to be basin configuration, fluctuating liquid levels, waste water solids, and alpha and KLA values. (Hancuff-Texas)
W70-07734

OXYGENATION EFFICIENCY OF A BLADED ROTOR,
Iowa State Univ., Ames.
John L. Cleasby, and E. Robert Baumann.
Journal of the Water Pollution Control Federation, Vol 40, No 3, p 412-424, March 1968. 8 fig, 18 ref.

Descriptors: *Oxygenation, *Rotors, Design, Pilot plants, Dissolved oxygen, Aeration, Concentration (Composition), Efficiency, Pressure, Temperature, Turbulence, Waste water treatment.
Identifiers: *Mechanical aerators, Diffusers, Power.

Increased use of many modifications of the activated sludge waste treatment process has focussed attention on the need for efficient aeration devices. The results of a study performed on a bladed rotor mechanical aeration device is reported. The oxygenation capacity at speeds of 60 to 120 RPM and rotor immersions of 3 to 12 inches ranged from 3.4 to 5.0 O2/HP-hr under standard conditions. The actual oxygenation capacity under standard conditions including the power required for motor, gear reducer, and rotor should be approximately 75% of the above values. Forty-five ex-

erimental runs were conducted covering five different rotor speeds and four different rotor immersions. Because of difficulty analyzing data reported n the literature for diffused aeration systems (reorted as a per cent oxygen absorption), the rotor tudies were compared with one typical hypothetial diffused aeration installation. The rotor system vas found to be much more efficient with the difused air system producing 0.81 lb O2/HP-hr. (Hancuff-Texas)
W70-07735

A NEW PRODUCT CONCEPT FOR IMPROVEMENT OF INDUSTRIAL WATER,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
William T. Robinson, and Robert J. Mattson.
Journal of the Water Pollution Control Federation, Vol 40, No 3, p 439-446, March 1968. 9 fig, 6 tab, ref.

Descriptors: *Industrial waste, Membrane processes, Reverse osmosis, Waste water treatment, Efficiency, Biochemical oxygen demand, Concentration (Composition).
Identifiers: *Refractory organics, Fibers, Polymers.

Du Pont is conducting research on the potential application of polymeric membranes as a new process for industrial waste treatment. In many areas the largest advantage for using membrane separation technique is that materials which are pollutants at low concentrations may be reusable at higher concentrations. Results of a study on processes using small diameter hollow fibers are reported. The most common sizes range from 25 to 250 microns OD with wall thicknesses of 5 to 50 microns. The permeators used for study are 6 inches in diameter and have a length up to 7 feet. It is indicated that polymeric membranes differ in their ability to reject specific ions. An example is given whereby the chloride ion has 0% rejection and where the phosphate ion has 99%. Therefore, the possible degree of concentration would be much higher because the process would not have to work at a higher pressure to overcome the osmotic pressure of the chloride ions. Results of membrane rejection at 400 psig showed a COD reduction from 212 mg/l to 66, indicating a rejection of 69%. (Hancuff-Texas)
W70-07736

THE DISPOSAL OF NYLON WASTES,
Chemstrand Corp., Pensacola, Fla.
E. D. Remy, and D. T. Lauria.
Proceedings of the Industrial Waste Conference, 13th, 1959, p 596-624. 12 fig, 12 ref, 4 tab.

Descriptors: *Activated sludge, *Solvents, *Waste water treatment, Lagoons, Sedimentation, Flotation, Disposal, Streams.
Identifiers: *Nylon 66, Combusion, Adipic acid, Nylon salt, Solvent stripping, Man-made fiber plant wastes.

At the plant of Chemstrand Corporation near Pensacola, Florida, manufacturing nylon 66, the waste waters were formerly stored in lagoons and discharged to the Escumbia River during periods of high flow. When the plant was expanded, however, treatment of the waste waters became necessary. The more concentrated waste waters were burned to recover heat. Of the remaining waste waters, about 90% came from the manufacture of adipic acid, a principal component of nylon salt. Detailed studies were made on the treatment of these waste waters; the results are discussed, and shown in tables and graphs. It was found that one stream of adipic acid waste was best treated by solvent stripping, using a submerged combustion process. The stripped waste water could then be mixed with the second stream for biological treatment by the activiated sludge process. Sedimentation was found to be more effective than flotation for recovery of sludge. Based on the laboratory and pilot-plant studies, a full-scale treatment plant was put in operation in 1957 and has operated efficiently. (Livengood-North Carolina State)
W70-07741

GOOD HOUSEKEEPING IS BEST SOLUTION TO STREAM POLLUTION,
Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 05B.
W70-07756

TREATMENT OF WOOL SCOURING WASTES,
Worthen H. Taylor.
Sanitalk, Vol 1, p 13-14, 1952.

Descriptors: *Calcium chloride, Centrifugation, Turbidity, Suspended load, *Waste water treatment.
Identifiers: *Wool grease, *Wool scouring wastes.

This article relates to the treatment of wool scouring wastes by the addition of CaCl2 and centrifuging in a Sharples DG-2 centrifuge. This method resulted in a reduction of wool grease, turbidity, and suspended solids by 98-99 percent. The amount of CaCl2 used varied from 0.25 to 1.5 percent of the total weight of the wastes treated, the amount depending on the concentration of the wastes. However, wool scouring wastes resulting from the use of a minimum quanitity of water in scouring required less chemicals. The success of the process is adding the solution of CaCl2 three seconds before centrifuging and then holding the effluent in a skimming tank from 20 to 30 minutes. Temperature had little effect upon the process. (Livengood-North Carolina State)
W70-07758

BIOLOGICAL TREATMENT OF MIXTURES OF HIGHLY ALKALINE TEXTILE-MILL WASTE AND SEWAGE,
Cone Mills Corp., Greensboro, N. C.
R. H. Souther, and T. A. Alspaugh.
American Dyestuff Reporter, Vol 44, p 390-395, 1955. 1 fig, 10 tab, 7 ref.

Descriptors: *Sewage effluents, *Trickling filters, *Activated sludge, Biochemical Oxygen Demand, Color, Domestic wastes, Pilot plants, Waste water treatment, *Biological treatment.
Identifiers: *Textile mill wastes, Alkaline wastes, Finishing wastes, Dyehouse wastes.

Pilot plants studies are being made on the treatment of mixtures of domestic sewage and textile-mill dye and finishing wastes by high-rate trickling filters, by activated sludge, and by chemical treatment to determine the most economical and most efficient method for treating such a mixture. Results indicate that pretreatment through a trickling filter and subsequent treatment through activated sludge is the most efficient method and can be satisfactorily used for treating highly alkaline textile wastes. An usually high removal of BOD and color is obtained. Certain process changes in the plant were also made to reduce the BOD loading through the treatment plant. (Livengood-North Carolina State)
W70-07760

PURIFICATION OF THE SEWAGE WATERS FROM RAYON MANUFACTURING (IN RUSSIAN),
V. S. Morgenshtern, Ya. Z. Sorkin, Yu. E. Matuskov, and V. A. Malikov.
Khimicheskie Volokna, Vol. 1, p44-47, 1966. 1 fig, 3 tab.

Descriptors: *Lime, *Waste water treatment, Sulfates, Sodium sulfate, Sulfides, Cellulose, *Chemical precipitation, Surface waters, Setting basins, *Effluents.
Identifiers: *Textile wastes, Sulfuric acid, Zinc compounds, Carbon disulfide, Grease, Rayon (Regenerated cellulose fibers), Regeneration, Baths, Clarifying agent, Suspended residues, Contact clarifier, Soda, Sodium sulfide, Staple fibers.

Waste waters containing sulfuric acid, corrosive nitrogen compounds, sulfates of sodium and zinc, carbon disulfide, hydrogen and other sulfides, thiocarbonates, cellulose pulp, and grease result from rayon manufacturing. Today viscose rayon plants use regeneration of the plastification, and precipitation baths to reclaim chemicals and to clean wastes to meet regulations protecting surface resevoirs. Lime is used as a reagent in a two-stage scheme of purification. Settling tanks or clarifying agents handle suspended residues and a contact clarifier guarantees removal of zinc from the effluent. Soda and sodium sulfide are used to regenerate zinc from effluents of the manufacture of high-strength rayon tirecord and staple. (Lonon - North Carolina State)
W70-07778

A DYNAMIC MODEL OF THE ANAEROBIC DIGESTION PROCESS,
Clemson Univ., S.C. Dept. of Environmental System Engineering.
John F. Andrews.
Proceedings of the Industrial Waste Conference, 23rd, 1969, p 285-310. 18 fig, 1 tab, 31 ref.

Descriptors: *Anaerobic digestion, *Simulation analysis, *Inhibition, *Hydrogen ion concentration, *Mathematical model, Anaerobic bacteria, Laboratory tests, Waste water treatment.
Identifiers: *Volatile acid concentration, *Process stability.

Process stability has been the major problem associated with the anaerobic digestion process. A dynamic model which utilizes an inhibition function to predict the failure of an anaerobic digester was presented. The key features of the model were: (1) the use of an inhibition function to relate volatile acid concentration and specific growth rate for the methane bacteria; and (2) consideration of the un-ionized acid as the growth-limiting substrate and inhibiting agent. The consideration of the un-ionized acid as the inhibiting agent resolves the conflict between volatile acid inhibition and pH inhibition because the concentration of un-ionized acid is a function of both total volatile acid concentration and pH. The model was kept as simple as possible by assuming that there was no lag phase, organism death, endogenous respiration, substrate utilization for maintenance energy, or inhibition byproducts. Experimental evidence from laboratory studies and evidence from the bacteriological literature were presented in support of the model. Simulation studies, utilizing a digital-analog simulation program (PACTOLUS), of both batch and continuous flow systems provided additional evidence by predicting results commonly observed in the field during the start-up, or failure, or recovery of anaerobic digesters. The simulation studies should be considered as only semiquantitative as reliable values of the growth parameters were not available. (Galwardi-Texas)
W70-07804

ANNUAL DIGESTER UPSET CORRECTED,
San Mateo Waste Water Treatment Plant, Calif.
John P. Lee.
Water and Sewage Works, Vol 116, No 2, p 56-58, Feb 1969. 1 fig, 3 tab.

Descriptors: *Anaerobic digestion, *Operation and maintenance, *Waste water treatment, Hydrogen ion concentration, Lime, California, Activated sludge, Sludge digestion.
Identifiers: *Volatile acids, Carbon dioxide, Gas production, San Mateo (Cal).

San Mateo, California has experienced three identical primary sewage digester upsets in the past three years at its municipal waste water treatment plant. The primary digester handles approximately 20,000 gallons of thickened sludge per day. The upsets were characterized by (1) an increase in the volatile acid content of the digester, (2) an increase in the carbon dioxide fraction of the gas produced and (3) a dramatic decrease in gas production.

Operational data were presented for the periods just before, during and after correction of the upsets for each of the three years. For instance, volatile acid content increased from 108 to 2070 mg/l while CO2 increased from 27 to 43 and gas production decreased from 91,600 to 47,200 cu. ft. during the upset of 1966. The breaking up of the grease blanket on the top of the digester at the start of warm weather increased the activity of the acid-forming bacteria. Control of the upsets was obtained by the addition of up to 600 pounds of lime and the diversion of the raw sludge to the secondary digester. (Galwardi-Texas)
W70-07805

START-UP PROBLEMS AT A METROPOLITAN DISTRICT PLANT,
Metropolitan Denver Sewage Disposal District No. 1, Commerce City, Colo.
Louis D. Kifer.
Journal of the Water Pollution Control Federation, Vol 40, No 7, p 1338-1345, July 1968.

Descriptors: *Sewage treatment, *Operations, *Failures, *Equipment, Control systems, Waste water treatment, Sludge disposal, Chemicals, Incineration, Pumps, Irrigation, Personnel.
Identifiers: *Blowers, Suspended solids, Air flow, Start-ups.

The large number of start-up problems encountered at the Metropolitan Denver Sewage Treatment Plant in Colorado are described. The plant includes primary treatment for part of the wastes and activated sludge for treating both these and wastes given primary treatment elsewhere. Initial start-up problems included foam build-up on the primary tanks due to clogging of the foam dispersion spray system (cured by utilizing secondary effluent in place of primary). All four blowers of the plant failed within 74 hours after the start of operation. This was due to the veins pulling away from the main portion of the wheel, resulting in stricking the casing. After the second start-up further problems developed. These included improper hydraulic control of the aeration tanks; deposition of oil fractions in the control system; air drops due to leaking at knee joints, caked grease in the tank due to underdesign of pumps; difficulty in furnishing adequate volumes of sludge to the vacuum filters; and further problems in sludge conditioning, drying, incineration and further difficulties in blower operation. (Hancuff-Texas)
W70-07806

CENTRAL PRE-TREATMENT OF OMAHA PACKING HOUSE WASTE WATERS,
Omaha Dept. of Public Works, Nebr.
E. Bruce Meier, and William E. Korbitz.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 627-636, Apr 1968. 10 fig, 1 tab.

Descriptors: *Industrial waste, Waste water treatment, Design, Sedimentation, Financing, Profit, Costs, Farm wastes, Livestock wastes, Cattle, Hogs, Sheep.
Identifiers: *Meat packing, Flotation, Solids, Collection, Fats, Greases, Processing.

The daily kill day discharges of waste water from the meat packing operations in the City of Omaha average more than 15 million gallons and contain at least 70 dry tons of suspended solids in addition to approximately 25-40 dry tons of animal fat. The suspended solids are predominantly kill floor scraps and paunch manure from cattle, hogs and sheep. The simple and inexpensive method of paunch manure and grease disposal by sluicing from the premises is no longer acceptable. The difficulty of owning and operating privately 18 separate facilities would be difficult if not impossible. The City and industry joined hands in an effort to find an economically feasible solution. The final solution involved the design of collector sewer systems, gravity settling basins, conventional dewatering and conveying facilities, air flotation units, solids and skimmings storage, and a continuous dehydration system for skimmings using oil as a process vehicle. The pre-treated waste water will be discharged to the city sewers. Total estimated cost of the Omaha plant is 6.7 million dollars and will be financed chiefly by bonds. The bonds will be funded from revenues derived from the sale of processes grease recovered from the two-stage facility, and by payments from individual packing companies. (Hancuff-Texas)
W70-07807

SUBSTRATE UTILIZATION IN HETEROGENOUS COMMUNITIES,
Harvard Univ., Cambridge, Mass.
Elisabeth Stumm-Zollinger.
Journal of the Water Pollution Control Administration, Vol 40, No 5, Part 2, p R213-R220, May 1968. 4 fig, 4 tab, 25 ref.

Descriptors: *Microorganisms, *Biodegradation, *Cultures, Bacteria, Natural streams, Activated sludge, Growth rates.
Identifiers: *Heterogenous systems, Glucose, Consumption, Substrate utilization.

Mixed laboratory cultures growing on non-selective multi-substrate medium do not simulate satisfactorily a natural bacterial population because accumulation leads to selective enrichment of one or several types. A mixed acclimated laboratory culture resembling a natural community in kind and relative abundance can be reconstituted from pure cultures of natural isolates. The slowly growing bacteria of natural waters can utilize many substrates concurrently, but sequential substrate utilization can occur where a few substrates predominate in solution enriching the microorganisms favored by these substrates. Sequential substrate utilization was observed in coliform dominated cultures. (Hancuff-Texas)
W70-07808

PRETREATMENT OF SEWAGE SLUDGE,
Technische Hochschule, Aachen (West Germany). Institut fuer Siedlungswasserwirtshaft.
B. Boehnke.
4th International Congress of the IRGR, (International Research Group on Refuse Disposal) Based, 2-5 June 1969, working group 5, p 608-614. 1 fig, 1 tab.

Descriptors: *Sludge, *Sludge disposal, *Sludge treatment, *Sewage sludge, *Sewage disposal, *Sewage treatment, *Sludge digestion, Aerobic treatment, Anaerobic digestion, Dewatering, Drying, Filtration, Vacuum drying, Centrifugation.
Identifiers: *Sludge pre-treatment, Aerobic digestion.

Solid waste and sludge production in West Germany amount to some 50 x 10 6m3 per year, of which 40% or 20 x 10 6m3 is raw, unthickened sewage sludge. With increasing population and decreased agricultural use of sewage sludges as fertilizer, new methods of treatment and disposal must be found. Methods of disposal acknowledged by experts include incineration, composting, and tipping (sanitary landfill). Sludge processing must fulfill two basic requirements. (1) The sludge must be stabilized through decomposition of high value proteins and carbohydrates into low valued ones. (2) volume must be reduced by removal of ballast water. The 20 x 10 6m3 sludge produced yearly in West Germany, if treated anaerobically and dried to 60% water, could be reduced in volume to 2.4 x 10 6m3 of a paste-like material and easily stored. Dehydration to 60% water yields a tenfold disposal volume, but further dehydration to 40% water content increases disposal volume only another 50%. Further reduction in water content is uneconomical. Dehydration may be acheived by centrifugation or filtration. Both processes are discussed briefly. (Makela-Texas)
W70-07809

CHEMICAL PROCESSING OF WASTE WATE FOR NUTRIENT REMOVAL,
Stanford Univ., Calif.
Rolf Eliassen, and George Tchobanoglous.
Journal of the Water Pollution Control Federatio Vol 40, No 5, Part 2, p R171-R180, May 1968. fig, 4 tab, 9 ref.

Descriptors: *Nutrients, *Nitrogen, *Phosphoru *Waste water treatment, *Costs, Chemicals, Ab sorption, Chemical precipitation, Electro-dialysi Disposal, Efficiencies, Ion exchange, Sewage trea ment.
Identifiers: *Methods, Removal.

Nutrient removal methods can be classified a biological, chemical and physical. Chemica methods for the removal of nitrogen include; am monia stripping, ion exchange, and electro-chem cal treatment. Chemical precipitation, io exchange, sorbtion, and electro-chemical trea ment are also available for removal of phosphorus Typical removal efficiencies are 80-98% nitroge and 85-99% for phosphorus. The key factors i planning and designing nutrient removal facilitie are the nutrients to be removed, the use of treate waste water, means for ultimate disposal of con taminants, and economic feasibility. Costs for dif ferent processes vary widely. For example, so spreading varies between $0.001 to $0.3/1000 ga While deep-well injection varies between $13 an $27/1000 phosphorus removal varies between $4 and $70 per million gal. (Hancuff-Texas)
W70-07810

THE TREATMENT OF KIER LIQUOR IN AD MIXTURE WITH SEWAGE,
Sewage Works, Saddleworth (England).
K. A. Deighton.
Water Pollution Control, Vol. 66, No. 5, p 484 491, 1967. 8 tab.

Descriptors: *Activated sludge, *Waste wate treatment.
Identifiers: *Textile mill wastes, *Pulp mill wastes Caustic liquor, Kier process.

The Greenfield, Lancaster, England sewage disposal system was quite capable of handling the trade waste from the area, including some textile mills and dye houses until a cigarette paper purifying plant was built. Studies showed that the caustic liquor from the kier boiling of pulp would over load it. Laboratory and pilot plant experiments developed methods and modifications in the sewage plant. It was found that sewage containing kier liquor and other trade effluents could be suc cessfully purified by two-stage treatment using a partial-treatment activated-sludge plant followed by biological filtration. While no set of conditions ensured a 30:20 effluent at all times, departure from this were generally slight. On average, during the later stage of the experiment, effluents were within the 30:20 standard. (Work - North Carolina State University)
W70-07811

EFFECTIVE MIXING ENERGY ON SLUDGE YIELD AND CELL COMPOSITION,
Oklahoma State Univ., Stillwater.
M. D. Rickard, and A. F. Gaudy, Jr.
Journal of the Water Pollution Control Federation, Vol 40, No 5, Part 2, p R121-R144, May 1968. 11 fig, 2 tab, 20 ref.

Descriptors: *Mixing, *Activated sludge, *Microorganism, Dissolved oxygen, Sewage treatment, Biological treatment, Sludge, Laboratory scale, Waste water treatment, Chemical oxygen demand, Biological oxygen demand, Turbulance, Bacteria.
Identifiers: *Agitation, *Compositions, RNA, DNA.

Operation of a steady-state bacterial system at a constant dilution rate with varying agitation rates has shown that solids yield and oxygen uptake both

with the amount of agitation provided. As a sure of agitation, the average velocity gradient as measured. The decrease in solid yield with easing turbulance appears to occur primarily at expense of cellular carbohydrate. This results in production of a sludge having a higher protein tent at a higher agitation rate. On the basis of ature cited, and work presented five hanisms are advanced to explain the increased gen uptake and decrease in solids yield. These (1) change in predominance, (2) increased uency of contact between cells and substrate, production of smaller floc particles with ltant improved penetration of substrate and ox-n, (4) increase in the rate of oxygen transfer ss cell liquid interfaces, (5) maintenance of a er DO concentration with increasing turbu-e. Although none of these mechanisms can be inated, the increased oxygen uptake probably lts from the reduction in the cell liquid interfa- resistance to oxygen transfer with increase of ing energy and decrease in the biological solids d probably results from an increased ratio of iration to synthesis. (Hancuff-Texas)
0-07812

SIGN AND OPERATION OF THE FIRST GESTER GAS TURBINE IN THE U.S.A.,
ollo (John) Engineers, Lafayette, Calif.
Harvey Hunt, and William N. Clarke, Sr.
rnal of the Water Pollution Federation, Vol 40, 7, p 1346-1357, July 1968. 4 fig.

criptors: *Turbines, *Digestion, *Fuels, dge, Waste water treatment, Costs, Operations, ign, Sewage treatment, Sludge digestion.
ntifiers: *Power generation, *Gas turbine en-e.

e gas turbine now in operation at the County itation Districts of Orange County, California, he first in the United States and the second in world to utilize waste digester gas as a fuel. The er presents the thinking and decisions which d to the turbine system's design, installation and ration. The turbine generator is suited ideally peaking and stand-by power generation as it is necessary to start a boiler and wait for steam eration before power can be produced. Also the bine requires much less space than the diesel en-e. The unit is light weight and can produce 70 to 0 kilowatts of electrical energy per ton of total chinery as compared to 27 kilowatts per ton h the diesel engine. One of the biggest ad-ntages of the gas turbine is that no water is ded for either cooling or power, with the excep-n of water required to cool the gas. The turbine rchased is a dual fuel type rated at 1080 owatts, and drives a synchronous brushless alter-ing current generator rated at 1000 kilowatts. e exhaust gas from the turbine passes through a at recovery unit which has a steam capacity rat-of 12,500 pounds per hour. The steam from this t drives a steam turbine which in turn drives a 0 kilowatt induction generator. The initial cost the above equipment was $250,000. Cost for in-llation was $261,000. (Hancuff-Texas)
70-07813

FECT OF PRIMARY EFFLUENT SPENDED SOLIDS AND BOD ON AC-VATED SLUDGE PRODUCTION,
and Rapids Water Pollution Control Plant, ch., and Dow Chemical Co., Midland, Mich.
ris Voshel, and J. G. Sak.
rnal of the Water Pollution Control Federation, l 40, No 5, Part 2, p R203-R212, May 1968. 8 , 3 tab, 10 ref.

scriptors: *Activated sludge, *Biochemical ox-en demand, *Operation, Costs, Sewage treat-nt, Chlorine, Waste water treatment, Sedimen-ion.
ntifiers: *Suspended j solids, *Concentration, r supply, Grand Rapids, Michigan, Polymers, occulation.

The Grand Rapids Water Pollution Control Plant was constructed in 1929, and consisted of a primary plant only. In 1953 the plant was expanded to include the activated sludge process, and again in 1958 it was further expanded. The primary effluent suspended solids level was observed to have a major influence on the total weight of excess sludge production. The primary effluent suspended solids can be controlled by addition of an organic flocculant to the raw waste water stream. Approximately 1 mg/l of anionic polymer was added to the raw waste water ahead of the grit channel. Little flocculation occurred in the grit channel, but turbulence at the proportional weirs of the channel exit provided excellent mixing. The resulting flocculation removed a greater portion of BOD than is removed normally across the primary clarifier. Additional removal of suspended solids and BOD across the primaries resulted in reduction of extra sludge. Primary effluent suspended solids dropped from 112 mg/l to 45 mg/l. The primary effluent BOD dropped from 77 mg/l to 54 mg/l. Excess activated sludge production was reduced from 34,000 lbs/day to 13,500 lbs/day. Savings in the plant operating costs resulted from reduction of aeration air requirements, decrease in chlorine demand and improved filterability of the sludge. The final effluent quality also improved. (Hancuff-Texas)
W70-07814

DECOMPOSITION OF PYRUVIC ACID,
Bureau of Sewers, Baltimore, Md.
C. E. Keefer, and H. Watkins.
Journal Water Pollution Control Federation, Vol 40, No 5, Part 2, p R230-R234, May 1968. 3 fig, 2 tab, 1 ref.

Descriptors: *Anaerobic conditions, *Degradation (Decomposition), Digestion, Sludge, Methane, Waste water treatment, Sewage treatment.
Identifiers: *Pyruvic acid, *Volatile acid.

The results of three experiments investigating the decomposition of pyruvic acid seeded by digested sludge are shown. In the first experiment pyruvic acid additions amounting to 1.5% of the dry volatile solids in the sludge were made for a period of 28 days. The pH varied from 7.64 to 8.09 volatile acids ranged from 995 to 1407 mg/l, and gas production averaged 513 ml/g of acid added. Methane gas production varied between 40.3 and 48.7%. This was followed by a 7-day period in which acid additions were increased to 3.5% of the dry volatile sludge solids, which in turn was followed by an increase to 5.5%. With the increases in feed there was marked decrease in pH and a marked increase in volatile acids. The same tests were run on two additional sludges. (Hancuff-Texas)
W70-07815

MODELING AND OPTIMIZATION OF STEP AERATION WASTE TREATMENT SYSTEMS,
Kansas State Univ., Manhattan.
Larry E. Erickson, Y. S. Ho, and L. T. Fan.
Journal of the Water Pollution Control Federation, Vol 40, No 5, Part 1, p 717-732, May 1968. 6 fig, 2 tab, 5 ref.

Descriptors: *Mathematical models, *Activated sludge, *Kinetics, Optimization, Mixing, Aeration, Sewage treatment, Waste water treatment.
Identifiers: *Step aeration, Growth, Sludge flow, Completely mixed.

Several flow systems for use with the step aeration process have been examined under optimal operating conditions. These systems include several completely mixed tanks in series, several plug flow systems, and a composite system composed of a completely mixed aeration tank and a plug flow aeration tank. After making simplifying assumptions the optimum operating conditions were determined using a discrete version of the maximum principle. The optimization studies show that allocation of feed along the system is desirable under the conditions that are considered in this study. In other words, the step aeration system is theoretically desirable in some types of operating situations. The study also shows how to determine the optimum allocation and the optimum tank volumes for a given type of step aeration system. When all the systems that were considered are compared, the plug flow system with continuous feed allocation along it minimizes the required volume. The mathematical model used was developed based on certain simplifying assumptions and is considered only an approximation of the complex treatment process. (Hancuff-Texas)
W70-07816

PURIFICATION OF WASTE WATERS FROM THE VISCOSE RAYON INDUSTRY (IN RUSSIAN),
E. A. Kulakov, and I. N. Myasnikov.
Zhurnal Vesesoyuznogo Khimicheskogo Obshchestia IM D.I. Mendelyeva Vol. 12, No. 6 p 638-644, 1967.

Descriptors: *Separation techniques, *Hydrogen sulfide, *Waste water treatment.
Identifiers: *Viscose rayon, Purification, Cellophane, Viscose rayon plant wastes, *Carbon disulfide, *Zinc salts, Suspended solids.

The purification of waste waters obtained from production of continuous filament viscose rayon (900 m. 3/ton), viscose rayon staple (500 m. 3/ton), viscose rayon tire cord (700 m. 3/ton), and cellophane (750 m. 3/ton) is described. Separation processes are suggested for removing all impurities, including acidity 4-8.5 meg./l., pH 2.5-2.8 and CS2 20-100, H2S 5-25, Zn salts 20-75, suspended material 120-470, dry residue 2700-6500, and calcined residue 2200-3500 mg./l. (Livengood - North Carolina State University)
W70-07817

BIOLOGICAL CHEMICAL COMBINATION DRAMATICALLY CUTS TREATMENT COSTS,
Ben Davis, and Syd Love.
Water and Pollution Control, Vol 107, No 5, May 1969. p 35-37. 3 fig.

Descriptors: *Biological treatment, *Waste water treatment, *Sewage treatment, *Chemical precipitation, Biodegradation.
Identifiers: Cyanide, Kukland Lake (Ontario).

The community of Kukland Lake, Ontario, produces a high volume of very weak sewage due to excessive infiltration and running of water taps in winter to prevent freezing. In 1965, it was decided to treat this waste and an investigation was initiated. Two hour settling tests yielded 25% BOD removal and 31% SS removal, and showed primary treatment alone would be insufficient. A biodegradability study showed a bulking sludge due to the presence of a toxic substance later identified as cyanide in concentrations of 0.04-0.80 mg/l. In the absence of the cyanide, it was expected contact stabilization would work, but the dilute nature of the sewage would inhibit sludge development. A coagulation study using jar tests resulted in 85% reduction in BOD and suspended solids (SS) at a cost of 2.0-2.5 cents per 1000 gallons. A pilot plant was built and yielded 85% SS removal and 60% BOD reduction with chemical dosages of 8 mg/l lime, 28 mg/l alum and 0.5 mg/l Dow Purifloc A-21, an anionic copolymer. Since BOD removal could not be increased above 60%, a combination chemical-biological pilot plant was tried. With chemical dosages of 20 mg/l alum added directly to the aeration tank Dow A-23 anionic copolymer added to the mixing compartment, a BOD reduction of 83% and SS removal of 90% was achieved. The effluent BOD was consistently less than 24 mg/l. (Makela-Texas)
W70-07818

A PREDICTIVE MODEL FOR THE DESIGN OF FLUID BED ADSORBERS,
Michigan Univ., Ann Arbor.
Thomas M. Keinath, and Walter J. Weber, Jr.

Journal of the Water Pollution Control Federation, Vol. 40, No. 5, p 741-765, May 1968. 14 fig, 1 tab, 29 ref.

Descriptors: *Activated carbon, *Design, *Columns, *Mathematical models, Adsorption, Waste water treatment, Organics, Mass transfer, Diffusion, Reclamation, Reuse, Herbicides, Beds, Depth.
Identifiers: *Fluid bed, Concentration.

A mathematical model describing mass transfer rates for organic pollutants in fluid bed adsorbers is presented. The model has been found to predict adequately the concentration time profiles for systems in which liquid flow rate, particle size of adsorbant, solute concentration, and depth of bed have been varied. Good agreement between experimental data and predicted adsorption behavior is demonstrated. Prediction of the breakthrough curves has been facilitated by measurement of specific adsorption and mass transfer parameters and simple batch-type systems. Because determination of film diffusion controlled mass transfer coefficients is not possible with rapidly agitated batch-type systems, these values have been obtained from generalized correlation of a transfer factor j with the systems specific parametric group (NR/NGA). Conversely, internal diffusion controlled mass transfer coefficients have been determined in non-flow systems and have been shown to be less important than external diffusion control kinetic parameters in determining the overall rate of mass transport. It appears reasonable that the model can be extended to prediction of concentration time profiles for each component of a complex mixture of pollutants. (Hancuff-Texas)
W70-07819

RECOVERY OF CYANIDES BY MODIFIED SERFASS DISTILLATION,
Federal Water Pollution Control Administration, Grosse Ile, Mich.
Charles T. Elly.
Journal of the Water Pollution Control Federation, Vol. 40, No. 5, p 848-856, May 1968. 1 fig, 7 tab, 5 ref.

Descriptors: *Chemical analysis, *Distillation, *Industrial waste, Waste water treatment.
Identifiers: *Cyanides, *Detection, *Determination, Recovery, Serfass distillation.

A significant improvement of simple and complex recovery is developed through a modification of a standard method for determining cyanides. The modified method is effective for measuring cyanide from 0.01 mg/l to higher concentrations of over 1 mg/l. The method is effective for detecting the number of complex cyanides as well as cyanide in domestic and industrial waste water and river water. The proposed method works on nearly all types of samples encountered. The modification which prevents the formation of complex mercuric cyanide ion consists of adding 10 ml of mercuric chloride and 30 mg of magnesium chloride to the standard Serfass method. (Hancuff-Texas)
W70-07820

CONSIDERATIONS IN DIGESTED SLUDGE ELUTRIATION,
Canadian-British Engineering Consultants, Ltd.
T. G. Scott.
Water and Pollution Control, Vol 107, No 10, p 419, October 1969.

Descriptors: *Sludge disposal, *Sludge treatment, *Filtration, Anaerobic digestion, Lime sewage treatment, Waste water treatment.
Identifiers: *Elutriation, Vacuum filtration, Ferric chloride, Spent pickle liquor, North Toronto.

The elutriation process was considered in solving the problem of sewage sludge disposal. The elutriation tank at the North Toronto Sewage Treatment Plant was fitted with a thickener mechanism. Plant effluent was used as elutriation wash water and mixed with the digested sludge in ratios varying from two to one, to eight to one. Satisfactory filtration was obtained on the vacuum filter using both a chemical dosage of ferric chloride at the rate of 4% by weight of the solids filtered along with 6.5% lime and spent pickle liquor along with 10% lime. A substantial reduction in conditioning chemical demand by the removal of as much as 80% of the digested sludge alkalinity was noted. Problems of filtrate disposal were also eliminated as the filtrate was returned to the elutriation tank. (Galwardi-Texas)
W70-07821

SIMPLIFIED AUTOMATED VOLATILE FATTY ACIDS ANALYSIS,
National Inst. for Water Research, Pretoria (South Africa).
J. E. Harwood, and D. J. Huyser.
Water Research, Vol 2, No 10 p 631-636, October 1968. 2 fig, 1 tab, 3 ref.

Descriptors: *Chemical analysis, Laboratory tests, Anaerobic digestion, *Automation, *Analytical techniques, Waste water treatment, Sewage treatment.
Identifiers: *Volatile fatty acids, *Manifold design, Pretoria, South Africa.

A method is proposed for the automated determination of the total volatile fatty acid content of aqueous samples. The manifold used in the proposed method is simpler and the method quicker than existing procedures. The long mixing coils used for mixing two reagent streams before addition to the sample streams are omitted. A flow diagram of the manifold is presented. Sampling speeds have been increased from 10 to 15 samples/hr to 30 to 40 samples/hr at a 1:2 sample/wash ratio. A steadier base-line is obtained using the simplified manifold. No special preparation of the reagents is required. Accuracy is improved by introducing the determination of a sample blank, which makes allowances for any natural color introduced by the sample itself. A comparison of manual and automatic analyses with and without blank correction is presented. (Galwardi-Texas)
W70-07822

SOILS SYSTEMS FOR LIQUID WASTE TREATMENT AND DISPOSAL: ENVIRONMENTAL FACTORS,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
Warren A. Schwartz, and Thomas W. Bendixen.
Journal of the Water Pollution Control Federation, Vol. 42, No. 4, p 624-630, April 1970. 8 tab, 4 ref.

Descriptors: *Liquid wastes, *Groundwater, Waste water treatment, Biological treatment, Disposal, Chemical oxygen demand, Temperature, Depth, Vegetation, Lysimeters.
Identifiers: *Soil systems.

A study of the interaction of environmental factors with design factors such as dosing frequency, and waste pre-treatment is an essential prerequisite for the establishment of design principles for soil systems. A number of environmental factors were investigated for their effect on the treatment potential and hydraulics of soil systems. The parameters used for this investigation were chemical oxygen demand, MBAS, ammonia-nitrogen, and hydraulic longevity. The controlling factor for hydraulic longevity and treatment efficiency was the effect of depth in shallow systems, 2 to 4 feet. It is reported that this is probably due to the limited reaeration opportunity in the unsaturated zone. The effects of climate on removal efficiency are also studied. The tables are given presenting the effect of unsaturated depth on performance, interaction between climate and pre-treatment, interaction between climate and dosing frequency, and effect of vegetation on performance. In studying the climatological effects, the mean daily temperature in winter was 33 deg. F and in summer was 73 deg. F. Summer longevities were uniformly three times the winter longevities. It should be noted that the early days of operation are critical for the rate of biological development and extended longevities. The un started in summer ran through the following wint without any difficulty. (Hancuff-Texas)
W70-07823

TRAINING AND CERTIFICATION OF WAST WATER OPERATORS IN TEXAS,
Huppert (Jack) Co., Inc., San Antonio, Tex.
Jack E. Huppert.
Journal of the Water Pollution Control Federatio Vol. 42, No. 4, p 641-644, April 1970. 1 tab.

Descriptors: *Training, *Education, Sewage trea ment, Waste water treatment, Operations, Permit
Identifiers: *Certification, Responsibility, Licens Texas.

The history of the development of certification the State of Texas is presented. The program bega on a voluntary basis in 1939 and was so well a cepted that by 1945 certification became mandat ry without opposition. Almost 600 certificates we issued under the voluntary plan and were 'gran fathered' when the mandatory law was passe Cooperation between state agencies, operat groups, universities, and municipal officials h been the key to success of the program for trainin and certifying operators. An annual short school held each year on the campus of Texas A and M University. The school extends over a period of days with one half of the time devoted to wat works instruction and one half to waste water i struction. The Texas Water Utilities Associatio encompasses 40 district associations and has a tot membership of approximately 40,500. Monthl meetings are held and attended by operators withi the areas. Programs consist of round table discus sions, education films, or lectures from visiting c local speakers. In addition to the monthly meeting some district associations within the region joi together to sponsor a 3 day short school. The re gion schools are designed to provide for those wh can not attend the annual short school at Texas A and M. A list of the various qualifications for cer tification of grades A through D is tabulated. A on and two year water and waste water technolog course is conducted at James Connally Technica Institute in Waco. (Hancuff-Texas)
W70-07824

FILTRATION TECHNIQUES IN TERTIARY TREATMENT,
Stanford Univ., Calif.
George Tchobanoglous.
Journal of the Water Pollution Control Federation Vol 42, No 4, p 604-623, April 1970. 15 fig, 8 tab 18 ref.

Descriptors: *Filtration, *Tertiary treatment, *Per formance, *Headloss, Sewage treatment, Waste water treatment, Activated sludge, Pilot plant, Tur bidity, Mathematical model, Design, Operations research.
Identifiers: *Removal mechanisms, Polyelec trolytes, Suspended solids.

A thorough investigation of filtration techniques used for treating settled secondary effluent is described. The removal efficiency for filtration without the addition of chemicals is primarily a function of grain size. Typical removal efficiencies using conventional single medium sand or anthracite filter beds with depths of 18 to 30 inches varied depending upon the grain size from 10 to 60%. In the filtration of settled effluent with and without the addition of chemicals turbidity breakthroughs were not observed within the headloss range studied, 8 to 10 feet. As presently designed the sand layer in most duel medium filter beds is not utilized effectively. In multi-media filter bed if the anthracite layer is greater than 16 to 20 inches media placed below the anthracite contributes little to the overall suspended solids removal. Polyelectrolytes can be used as an additive to achieve varying degrees of suspended solids removal from secondary effluents using single, dual and multi-media filter beds. The distribution of

pended solids within the filter can be controlled varing the amount and point of addition of yelectrolytes. The grain sizes utilized in this dy varied from 0.49 mm to 0.98 mm and dings varied from 2.0 gal/min/sq ft. to 10.0 min/sq ft. For studying the suspended solids noval the polyelectrolyte dosage varied from 20 40 mg/l, while the electrophoritic mobility was asured varying polyelectrolyte dosage from 0 to mg/l. (Hancuff-Texas)
0-07825

XICOLOGICAL ASPECTS OF WASTE ATER RECLAMATION--A PRELIMINARY PORT,
ifornia State Dept. of Public Health, Berkeley.
ce Ottoboni, and Arnold E. Greenberg.
rnal of the Water Pollution Control Federation, l 42, No 4, p 493-499, April, 1970. 2 fig, 2 tab, ref.

scriptors: *Water reuse, *Tertiary treatment, aboratory animals, Waste water treatment, dents, Growth rates, Activated sludge, Diseases. ntifiers: *Rats, *Toxic diseases, Tumors, Activi- Toxicology.

search on the toxicity of domestic waste water to s was conducted for a period of 18 weeks. mestic waste water, unchlorinated activated dge plant effluent, was provided as the sole ter source to a group of young rats, and the same mmunity's potable water supply was given to a ond, or control group. In this preliminary in- stigation of possible adverse effects of waste ter fed to rats it was observed that: (1) Male rats en waste water ad libitum gained more weight n control rats, on the average 15% heavier. (2) males given water had significantly smaller renal glands than control females, on the average % lighter. (3) Two male rats developed massive nors not previously seen in this rat strain at such young age. Possible causes for these differences d their significance are discussed. Trace organics ay be involved; until additional studies are mpleted, a tentative evaluation is impossible. ancuff-Texas)
70-07826

RVEY OF WASTE WATER TREATMENT ANT OPERATOR CERTIFICATION IN THE S.
ater Pollution Control Federation, Washington, C. Personnel Advancement Committee.

urnal of the Water Pollution Control Federation, ol 42, No 4, p 511-517, April 1970. 4 tab.

escriptors: *Waste water treatment, *Training, lucation, Classification, Surveys, Permits. entifiers: *Operators, *Certification, Licenses.

t the end of 1968, 21 states had mandatory pro- ams, 26 states had voluntary programs, and 3 ates had no programs. To date, two more states ve adopted mandatory certification. Approxi- ately 21,000 operators have been certified prior 1969. The states have identified 60,551 waste ater facilities as having certified operators. The rvey shows that approximately 21% of those cilities requiring certified operators did not have rtified operators and therefore may not have perating personnel meeting prescribed qualifica- ons. The survey clearly indicates a need for addi- onal persons who meet qualifications for employ- ent in water pollution control plants. The data hich were obtained and are tabulated presents the onsoring or administering agency, experience vels, academic requirements, job functions overed by certification programs, and employing rganizations. (Hancuff-Texas)
70-07827

IGNOSULFONATES IN PETROLEUM FER- ENTATION,
ritish Columbia Univ., Vancouver.
. L. Liu, and P. M. Townsley.
Journal of the Water Pollution Control Federation, Vol 42, No 4, p 531-537, April 1970. 9 fig, 2 tab, 2 ref.

Descriptors: *Fermentation, *Growth rates, Respiration, Microorganisms, Bacteria, Pulp wastes, Surfactants.
Identifiers: *Petroleum, *Lignosulfonate, Culture media, Kerosene, Vancouver (British Columbia).

The addition of polymerized lignosulfonates into hydrocarbon fermentation media greatly increases the fermentation rate and the yield of biomass. Lignin itself does not appear to decompose during the fermentation; however, immediately upon the addition and vigorous mixing a stable oil water medium emulsion is formed. This emulsion increases the hydrocarbon water interfacial area, thus overcoming the major factor limiting microbial activity. The removal of hydrocarbon as a growth limiting factor in fermentation greatly reduces the requirement for oil dispersion equipment. The effects of the addition of a commercial grade lignin and a surface active agent on acid production, oxygen uptake rate and cell yield are determined on cultures isolated by the kerosene enrichment procedure. The oxygen uptake rate as a function of the carbon chain length in the basic medium was determined. C7 to C11 showed significant increase in dry cell weight in the presence of commerical lignin. A comparison of the dry cell yield and the acid production as a function of kerosene concentrations also is determined. This study indicates that lignosulfonates may be an inexpensive ingredient in water and pollution control fermentations. (Hancuff-Texas)
W70-07828

STOP-GO DIGESTERS AT READING,
R. L. Summers, J. F. Marshall, and S. D. Wood.
Water Pollution Control, Vol 69, No 2, p 149-158, March-April 1970. 7 fig, 5 tab, 4 ref.

Descriptors: *Anaerobic digestion, *Toxicity, *Ammonia, Performance, Laboratory tests, Detergents.
Identifiers: *Anionic detergent, *Loading rates, Failure, Concentrations, Reading (England).

The conventional control parameters of anaerobic digestion gave no advance warning of a series of failures which were described. An empirical anaerobic 'activity' test in which digester samples were slug fed and hourly gas production rates recorded was proposed as a means of indicating environmental change and consequently could give an early indication of impending failure. Laboratory studies were conducted to investigate the toxicity of ammonia nitrogen and anionic detergent concentration on anaerobic digestion. Results showed severe suppression at an ammonia nitrogen concentration of 1500 mg/l with the anionic detergent level held at 2% of dry solids, and an ammonia nitrogen concentration of 1050 mg/l and anionic detergent as 2.4% of the dry solids. A related study of high loading rates is presented. Results from laboratory digesters showed that the loading rate could be increased from 0.1 lb volatile matter/cu ft-day to 0.3 lb volatile matter/cu ft-day. (Galwardi-Texas)
W70-07829

WATER MANAGEMENT SAVES MONEY,
C. R. Kolzow.
Water and Sewage Works, Vol 116, No 5, May 1969. p 6-7, 3 tab.

Descriptors: *Metals, *Industrial wastes, *Industrial water, *Water reuse, *Water users, Chromium, Water pollution control.
Identifiers: *Metal finishing industry, Zinc cyanide.

Water use in the U.S. increased from 40 bgd in 1900 to 320 bgd in 1960 and is expected to increase to 600 bgd by 1980. By reuse and recirculation, the total water requirement of industry can be reduced. 80% of total water is used in irrigation and 94% of this volume is consumed by plant growth or evaporation. Industry consumes only 8% of the water it uses. In-plant control of industrial wastes should be investigated. Every industry can reduce their primary water needs by process improvement, water conservation, and water reuse. Where cooling is the principle use, substitution of recycle for once through can reduce water intake by as much as 90%. Savings of $40,000 per year in a metal finishing plant were recognized as a result of installation of counter-current rinsing, chrome recovery, plating salt recovery, demineralized water recovery, zinc cyanide recovery, and temperature regulation. (Makela-Texas)
W70-07830

SEWAGE WORKS MAINTENANCE,
W. E. Oliver, B. J. Vousden, and E. G. Eves.
Water Pollution Control, Vol 69, No 2, p 166-169, March-April 1970.

Descriptors: *Maintenance, *Facilities, *Sewage treatment, *Labor, Management, Waste water treatment.
Identifiers: *Preventive maintenance, *Comminutors.

The method of preventive maintenance which evolved at the sewage treatment plant at the London Borough of Sutton is described. The basic concepts presented can be used as a foundation for almost any sewage plant. Equipment breakdown, and subsequent shut-down of plant operation can be avoided by a proper program of well planned preventive maintenance. All operating machinery should be lubricated regularly and inspected for defects in equipment or operation. Defects should be registered by a Defect Report, and Maintenance Reports should also be required. Certain commonly used spare parts should be stockpiled. Standardization of equipment is recommended both from the viewpoint of interchangeability of parts and decreased requirements for stockpiled parts not neglecting the increased familiarity of maintenance personnel working on only one line of equipment. Painting increases the life of equipment. The use of three coats of different color helps in inspection to see the coats are properly applied. Buildings, roads, and grounds need less frequent maintenance. (Makela-Texas)
W70-07831

ENUMERATION STUDIES ON METHANOGENIC BACTERIA,
National Inst. for Water Research, Pretoria (South Africa).
M. L. Siebert, D. F. Toerien, and W. H. J. Hattingh.
Water Research, Vol 2, No 9, September 1968, p 545-554. 5 tab, 2 ref.

Descriptors: *Anaerobic bacteria, *Methane bacteria, *Statistical methods, Carbon dioxide, Hydrogen, Vitamins.
Identifiers: *Media, Mineral salts, Fatty acids, Digester fluids, Rumen fluids, Acetate, Formate, Glucose, Colony counts.

A statistical comparison of various media for the enumeration of methanogenic bacteria was performed. A digester receiving a synthetic substrate was used as a source of innocula during these studies. Two experiments were carried out. In the first experiment eight treatments with five replications of each treatment, and in the second experiment twenty-two treatments with five replicates of each treatment were compared. A reduced medium containing mineral salts, vitamins, small amounts of fatty acids, carbon dioxide (22%) and hydrogen (78%) should be used for the enumeration of methanogenic bacteria. The addition of rumen fluid and digester fluids to the media seemed to have stimulated the growth of more colonies, some of which may have been non-methanogenic in origin. Additions of formate, acetate and glucose resulted in repressed bacterial counts in certain circumstances. (Galwardi-Texas)
W70-07832

ADVANCED TREATMENT OF PETROLEUM WASTE WATER BY AUTOXIDATION,
Prather and Prather, Tulsa, Okla.
B. Vail Prather.
Journal of the Water Pollution Control Federation, Vol 42, No 4, p 596-603, April 1970. 1 fig, 3 tab, 12 ref.

Descriptors: *Industrial waste, *Aeration, *Tertiary treatment, Waste water treatment, Chemical oxygen demand, Biochemical oxygen demand, Oil.
Identifiers: *Autoxidation, Refinery waste, Chemical oxidation, Aeration tower, Free radical.

Residual dissolved organic contaminants are harbingers of trouble in industrial water systems and must be reduced to a minimum before the waste water can be reused successfully. Methods of removal of these organic residuals generally fall into three classes: (1) Biological degradation, (2) Chemical oxidation, (3) Physical stripping. A chemical oxidation process which utilizes autoxidation reactions is described. The process takes advantage of stripping and cooling action as well as oxidation. A series of chain reactions in the autoxidation system are presented. The role in initiators in the formation of free radicals is discussed. Aeration techniques in design of an aeration tower are presented. The influence of biological activity on reduction of chemical oxygen demand was evaluated with the conclusion that chemical oxidation existed independently of biological oxidation. The results of this study indicated that the oxidation-aeration tower offers an economical method for removal of small organic residuals by autoxidation, and stripping of ammonia and other unwanted gases at about the same cost as that of cooling the water. The aeration tower used for these studies has a height of 25 feet, a width of 4 feet, and a depth of 6 feet. The volume of water charged to the tower which gave the best results was 25 gal/min/sq ft. and an air flow of 7600 cfm. Residence time for water flowing through the tower was estimated at 3 to 6 minutes. (Hancuff-Texas)
W70-07833

METAL-FINISHING WASTES CAN BECOME POTABLE WASTES,
Leeds and Northrup Co., North Wales, Pa.
F. C. Snowden.
Water and Sewage Wastes, Vol 116, No 5, p 9-11, May 1969. 4 fig, 2 tab.

Descriptors: *Industrial wastes, Copper, *Chromium, *Treatment facilities, Hydrogen ion concentration, Chemical reactions, Industrial waste, Waste water treatment, Oxidation, Reduction, Potential.
Identifiers: *Metal finishing, North Wales (Pa), *Cyanides, *Nickel.

A description of the waste treatment facility for Leeds and Northrup Company metal-finishing plant is presented. The major pollutants in the waste include cyanides, chromates, copper and nickel. At various times the effluent is either highly alkaline or acidic. The waste treatment facility is a Lancy Laboratories, Inc. design and is basically a series of processes, each designed to neutralize a particular contaminant. Each process is equipped with its own set of pH and/or ORP controls. A conductivity monitor checks steam condensate from the heating coils in the plating solutions. The treatment system provides for the removal of cyanide, nickel, chromium and copper in addition to neutralization of the waste. Equilibrium equations used in the design of each system were presented along with an average analysis of the waste stream after treatment. (Galwardi-Texas)
W70-07834

WATER REUSE IN INDUSTRY,
Engineering-Science, Inc./Texas, Austin.
E. F. Gloyna, D. L. Ford, and J. Eller.
Journal of the Water Pollution Control Federation, Vol 42, No 2, p 237-242, Feb 1970. 8 fig, 2 tab.

Descriptors: *Waste water treatment, *Oil industry, *Water reuse, *Industrial wastes, *Cooling towers, Cation exchange.
Identifiers: *Refineries, *Storm water runoff, *Collection system, Boiler blowdown.

A system designed to treat liquid wastes from oil refineries and produce a salable product is described. About 40 million gallons of spent phenolic caustic wastes and 20 million gallons of spent sulfide caustic wastes are shipped to the treatment plant. Known pollutants in the waste material include phenols, cresols, cresylic acid, mercaptans, sulfides, thiophenols, caustic soda, and heavy metals. The finished products are cresylic acid and sodium sulfide solutions. The waste water collection system consists of a comprehensive network of drip-pans, collection troughs, dikes, and tanks. This network is interconnected to the process system and cooling towers. The cooling towers are used to reduce the concentration of organics and to concentrate the undesirable precipitates. High concentrations of heavy metals are reported in the cooling tower sludge and total carbon in the settled sludge and filtrate, respectively, is about 200,000 mg/l and 50,000 mg/l. The first half inch of rainfall is diverted to tankage, the second half inch is sent to storage for ultimate use as cooling tower makeup water, and any uncontaminated excess storm water overflow is released to a nearby water course. Cation exchangers are used to treat blowdown from the boilers. (Galwardi-Texas)
W70-07835

DETECTION OF INDUSTRIAL WASTES IN MUNICIPAL SYSTEMS,
San Diego Water Quality Control Board, Calif.
Ladin H. Delaney.
Journal of the Water Pollution Control Federation, Vol 42, No 4, p 645-648, April 1970.

Descriptors: *Industrial waste, *Sewage treatment, *Sampling, Waste water treatment, Activated sludge, Digestion, Maintenance, Odor.
Identifiers: *Detection, *Surveilance, Collection systems.

Because of the wide range and infinite variety of industrial wastes it is almost physically impossible to install automatic sampling and analytical equipment that will do an adequate job of detecting all industrial wastes in a non-homogenous waste water flow such as municipal waste. It is necessary for operating and maintenance personnel to represent the first line of attack for industrial waste detection. A most important indication that an industrial waste is being discharged to the system is a change in color. Many industries impart a characteristic color to the waste water. Copper sulfate is blue, chromium is green, milk waste is white, slaughter house waste is red. Odors also can be an important indicator. Solvents and many other chemical have peculiar smells which will impart a different odor to the waste water. Temperature sometimes is an indication that thermal wastes are being discharged. Excessive amounts of water vapor rising from the influent stream should be investigated. Many times visual olfactory signs are not manifested and it becomes necessary to observe the side effects on the system itself. Corrosion is an excellent example. Other side effects are activated sludge and digester upsets. An example is cited in which an increase in sludge production was found to indicate a potential overload of the digester system. (Hancuff-Texas)
W70-07836

NTA REMOVAL BY ACTIVATED SLUDGE--FIELD STUDY,
Ohio State Univ., Columbus; and Proctor and Gamble Co., Cincinnati, Ohio.
K. S. Shumate, J. E. Thompson, J. D. Brookhart, and C. L. Dean.
Journal of the Water Pollution Control Federation, Vol 42, No 4, p 631-640, April 1970. 5 fig, 3 tab, 6 ref.

Descriptors: *Activated sludge, *Degradation (Decomposition), Removal, Operations, Waste water treatment, Sewage treatment, Detergents, Surfactants.
Identifiers: *Trisodium nitrilotriacetate.

A one MGD conventional activated sludge treatment plant was used for the study of trisodium nitrilotriacetate (NTA) degradation. The NTA was fed at a maximum expected level of 8 mg/l and was 90% removed by the activated sludge treatment. At a higher level, 16 mg/l, removal varied widely but averaged 75%. At no time did the addition of NTA have any effect on plant performance and degradation of NTA continued in the receiving stream and was probably essentially complete within two miles downstream. The data presented indicated that there is a very slight removal of NTA in the primary tanks amounting to an average of about 8% for the entire duration of the study. Variability of NTA removal increased with increasing NTA dosage resulting in a significant decrease in average removal. (Hancuff-Texas)
W70-07837

ALGAL PERIODICITY AND WASTE RECLAMATION IN A STABILIZATION POND ECOSYSTEM,
Iowa State Univ., Ames.
Ronald L. Raschke.
Journal of the Water Pollution Control Federation, Vol 42, No 4, p 518-530, April 1970. 2 fig, 6 tab, 40 ref.

Descriptors: *Waste water treatment, *Ponds, *Algae, Lagoons, Biochemical oxygen demand, Chemical oxygen demand, Phosphates, Nitrogen, Stabilization.
Identifiers: *Water reclamation, Variations, Composition.

In an attempt to evaluate possible procedures for meeting new standards of the Federal Water Quality Act, the Ames Water Pollution Control Department built a number of experimental ponds. One of them was made available for the present investigation in which the intent has been to study algal composition and periodicity, dissolved oxygen, pH, temperature, and the extent of reduction in 5-day BOD, COD, solids, phosphates, ammonia, and nitrates through the plant pond complex. The pond is 0.12 acres in area with a water holding capacity of 105, 562 gallons and an average depth of 2.53 feet. The pond detention time ranged between 3.7 to 4.2 days. Results showed that algal periodicity and BOD analysis may be influenced by algal inhibitors. Green fagellates dominated in winter and spring, while coccoid greens dominated in summer and fall. The maximum per cent removal at any one time was 78% and 75% for BOD and filtered BOD respectively. The maximum COD removal was 63%. Total suspended solids ranged from 458 to 687 which is less than a limit of 1000 mg/l set by the U.S. Public Health Service Standards. Ammonia nitrogen ranged from 0.0 to 21.0 mg/l and nitrate nitrogen ranged from 0.5 to 1.8 mg/l. pH ranged from 7.35 to 9.09 and temperature from 0.8 deg C to 29.9 deg C. The effluent usually met the Iowa Water Pollution Control Commission's standards for temperature, pH, dissolved oxygen concentration, but phosphorus and nitrogen contents were high. (Hancuff-Texas)
W70-07838

MICROBIOLOGY OF DOMESTIC WASTES, I. PHYSIOLOGICAL ACTIVITY OF BACTERIA INDIGENOUS TO LAGOON OPERATION AS A FUNCTION OF SEASONAL CHANGE,
Manitoba Univ., Winnipeg.
Harvest Halvorson, M. Ishaque, and H. Lees.
Canadian Journal of Microbiology, Vol 14, No 4, p 369-376, Apr 1968. 6 fig, 20 ref.

Descriptors: *Bacteria, *Domestic wastes, *Lagoons, Microbiology, Waste water treatment.
Identifiers: *Physiological activity.

ıe physiological activity of bacteria indigenous to midicontinental domestic waste disposal unit agoon) was studied over a period extending from id-May to the beginning of December 1965. A gorous climate induces a layer of ice over the goon for approximately 5 months of the year; this udy entailed the interval under ice-free condi-ons during the first year of operation. Samples ere collected roughly at weekly intervals and the tivity of the bacteria free of algae was studied ainst several arbitrarily selected organic sub-rates. The activity was found to be a function of) the number of bacteria, (b) the temperature of e lagoon, and (c) the nature of the best substrate. ıe most rapid rates of oxidation occurred with samino acids, acetate, and palmitate. Glucose, g albumin, and liqui-nox, a biodegradable deter-nt were oxidized in a variable manner. Maximum tivity occurred at 23 deg C, the highest tempera-re reached by the lagoon during the summer. The tes of oxidation decreased as a result of the onset fall but all activities were not affected equally by e same temperature change. (Aguirre-Texas)
/70-07948

IICROBIOLOGY OF DOMESTIC WASTES. II. COMPARATIVE STUDY OF THE SEASONAL HYSIOLOGICAL ACTIVITY OF BACTERIA NDIGENOUS TO A SEWAGE LAGOON,
Ianitoba Univ., Winnipeg.
arvest Halvorson, M. Ishaque, and H. Lees.
anadian Journal of Microbiology, Vol 15, No 6, p 63-569, June 1969. 2 fig, 35 ref.

escriptors: *Metabolism, *Sewage lagoons, Temperature, Bacteria, Domestic wastes, licrobiology, Waste water treatment.
lentifiers: *Physiological activity.

comparative study was made of the physiological ctivity of bacteria seasonally present in a sewage agoon which experiences warm summers and very old winters. Bacteria recovered from surface sam-les of lagoon water during summer were able to etabolize glucose, acetate, palmitate, creatinine, itamin-free casamino acids, egg albumin, and urea erobically at 25 deg C, the highest prevailing tem-erature during the summer. Under anaerobic con-itions, acetate and palmitate were the only sub-trates not metabolized. Bacteria recovered from amples of lagoon water taken during winter were ble to metabolize aerobically glucose, acetate, almitate, creatinine, and urea at 2 deg C, the revailing temperature under ice cover, but asamino acids and egg albumin were not etabolized aerobically at 2 deg C or 25 deg C. cetate, palmitate, casamino acids, and egg albu-in were not metabolized anaerobically by bac-eria in winter samples. Urea was hydrolyzed much nore rapidly by bacteria in the winter samples and probably the preferred nitrogen source for rowth under winter conditions. The optimum pH or oxidation of acetate and casamino acids by bac-eria in summer samples was 7.0; only 50% of the naximum activity was obtained at pH 9.0, virtually he highest pH that was found under natural condi-ions. Bacteria active at low temperatures con-ribute appreciably to the stabilization of domestic vastes by the lagooning method even under severe vinter conditions. (Aguirre-Texas)
W70-07949

A CHARACTERIZATION OF TUNA PACKING WASTE,
Hawaii Univ., Honolulu.
Michael J. Chun, Reginald H. F. Young, and Nathan C. Burbank, Jr.
Proceedings of the Industrial Waste Conference, 23rd, p 786-805, May 1968. 10 fig, 6 tab, 10 ref.

Descriptors: *Biodegradation, *Biochemical oxygen demand, *Biological treatment, *Fish, *Wastes, Nutrients, Toxicity.
Identifiers: *Characterization, *Treatability, *Tuna packing wastes.

The characterization of a tuna cannery waste revealed a pH, temperature and dissolved oxygen content suitable for biological treatment. The total solids content of the tuna packing waste was 17,900 mg/l of which 37% was organic matter. Biodegradation of the tuna waste was limited as indicated by a COD/BOD ratio of 0.4. Treatability studies conducted on the waste gave an average daily COD range from 1300 to 3250 mg/l and an average daily BOD5 range from 500 to 1550 mg/l. Excess nutrient material was present in the form of phosphorus and nitrogen with a BOD5/N/P ratio of 100/68/7. The tuna waste alone was not conducive to aerobic biological treatment due to some inhibitory or toxic reaction. Dilution with domestic sewage in a ratio of 4/1 resulted in a material that was treated to about 60% of the theoretical oxygen demand. Long-term BOD studies indicated that the nitrogenous oxygen demand was about 40% of the total demand. (Aguirre-Texas)
W70-07951

POLLUTION ABATEMENT TECHNOLOGY DEGREE OFFERED.
Charles County Community Coll., La Plata, Md. Dept. of Biology.

Water and Sewage Works, Vol 116, No 1, p 20-22, January 1969.

Descriptors: *Education, *Training, *Waste treatment, *Waste water treatment, Treatment facilities, Operation and maintenance.
Identifiers: Treatment plant operators.

In 1966, Charles County Community College began a project, the primary goal being the training of technical manpower in the fields of water pollution and waste management. An Associate of Arts degree will be awarded to graduates of the two-year, one summer curriculum which covers the background, theory, and technical training in each subject area. Facilities include a new building with classrooms and laboratories, and a functional waste treatment plant serving both the college and the community. Career opportunities are expected to be unlimited and may include such positions as treatment plant supervisor, field technician, laboratory technicial, and industrial waste technician. A listing of the proposed curriculum is included. (Makela-Texas)
W70-07952

FISH OIL AND PROTEIN RECOVERED FROM FISH PROCESSING EFFLUENT,
Kurita Water Industries Ltd., Yokahama (Japan); and Hayashikane Sangyo Co., Ltd., Shimonoeski (Japan).
Kenji Kato, and Shizuhiro Ishikawa.
Water and Sewage Works, Vol 116, No 10, p 412-416, October 1969. 5 fig, 6 tab, 1 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Fish, *Proteins, Fish handling facilities.
Identifiers: *Fish oil, *Product recovery.

Fish oil and protein are recovered as a valuable byproduct in the treatment of an effluent from a fish processing plant in Shimonoseki, Japan. Fish meat from horse mackerel, scabbard fish, and yellow croaker is first machined to remove head and guts, and then is separated from the bones to make a chop, with a yield of 60-65% by weight. Water is added to form a slurry. The slurry is put through a gravity settling unit and oil is removed by skimming. Meat solids are centrifuged to form a primary product. The effluent produced then passes into another unit where oil is removed by gravitational flotation. The oil is heated to 90 deg C to coagulate protein mixed in with the oil and the mixture is centrifuged to remove the protein. The underflow from the oil separator is sent to coagulation tanks where HCl is added to lower the pH from 6.0-7.0 to 5.0-5.5, and a coagulant aid is added. The coagulated protein is then subjected to pressurized floation for 30 minutes. The protein is removed by skimmers and is vacuum filtered. Recovered protein brings 0.6 cents/lb based on 82% moisture content. Recovered oil brings 3.5 cents/lb. A total of 25 tons of protein and 1.6 tons of oil are recovered daily from 1,170 tons of raw effluent. Suspended solids were reduced 86%, and BOD was reduced 77%. (Makela-Texas)
W70-07953

NEW FLOTATION AIR FOR PAPER MILL WHITE WATER SYSTEM,
Proctor and Gamble Co., Cincinnati, Ohio.
D. J. Hahn, J. J. Jende, T. F. Rich, and F. J. Tremel.
Water and Sewage Works, Vol 116, No 8, p 321-324, August 1969. 5 fig, 1 tab, 2 ref.

Descriptors: *Industrial wastes, *Flotation, Waste water treatment, Laboratory tests, Pilot plants, Performance, *Pulp wastes, Pulp and paper industry.
Identifiers: *Suspended solids, *Coagulant, *Cationic, *Guar gum, Full-scale unit, Concentration.

The establishment of new and more stringent suspended solids discharge allowances, required the improvement of the white water flotation process. Approximately fifty different chemicals were evaluated by the Charmen Paper Products Company for flotation improvement. Based upon the laboratory results, six chemicals were selected for further study in a pilot flotation unit. A modified cationic guar gum coagulant yielded the best results. The effluent suspended solids concentration dropped to less than 10 mg/l and the solids being scraped off the unit became noticeably more compact and thicker. Tests on full-scale units showed that the effluent suspended solids dropped from over 120 mg/l to less than 36 mg/l with an addition of about 2 mg/l of the chemical. (Galwardi-Texas)
W70-07954

WATER CONSERVATION REDUCES LOAD ON SOHIO'S WASTE TREATMENT PLANT,
Sohio Refinery, Lima, Ohio.
B. A. Rose.
Water and Sewage Works, Vol 116, No 9, p 4-8, September 1969. 3 fig.

Descriptors: *Industrial wastes, *Industrial water, *Oil, *Waste water treatment, *Water reuse, *Waste water disposal, *Oily water, Oil industry.
Identifiers: Oil-water separator.

The Sohio refinery at Lima, Ohio, on the Ottawa River currently processes 55,000 barrels of crude oil per day. This refinery burns about one billion BTU/hr in its furnaces, and requires 40,000 gpm of water for cooling purposes, if the water is used once, and picks up 30 deg F. Groundwater makes up the source of supply. Cooling towers permit recirculation of 40,000 gpm of water for cooling and condensing operations. Make up waters include 3000 gpm of well water to replace water lost by evaporation, physical loss, and the 1800 gpm of cooling tower blowdown. Smaller quantities of process waste waters also contribute to the plants waste stream. Recirculation of cooling waters conserves water, reduces the volume of waste water to be treated, and minimizes loss of pollutants. Sodium hydroxide solutions used in several treatment operations are regenerated for reuse or sold. Separate sewer systems allow recovery and reuse of lost chemicals. Water used in the high pressure hydraulic coke cutter is recycled to prevent contamination of oily waters with fines which might stabilize oil-water emulsions. Sulfides are removed in steam strippers, and phenolic waters are used as makeup in the crude oil desalting process. In spite of all closed sewer systems and conservation procedures, 2500 gpm of waste water are produced and need to be treated. Primary treatment occurs in an API oil-water separator, which recovers more than 300 barrels of oil per day. (Makela-Texas)
W70-07955

POULTRY PROCESSOR MEETS CHALLENGE OF INCREASED WASTE LOAD,
Gold Kist Poultry, Atlanta, Ga.
William J. Camp.
Water and Sewage Works, Vol 116, No 9, p 24-26, September 1969.

Descriptors: *Design criteria, *Industrial wastes, *Poultry, Waste water treatment, Biochemical oxygen demand (BOD), Performance, Farm wastes, Florida.
Identifiers: *Extended aeration, *Suspended solids, Live Oak (Fla).

Design criteria and operating results of an extended aeration treatment system for a complete poultry processing plant are presented. The processing plant is designed to handle 50,000 birds per day utilizing 10 gal of water per bird and have an organic load of 52 lb BOD per 1000 birds. The treatment system consists of a by-products collector tank, 80-minute detention time; two extended aeration tanks, 24-hour detention time; final settling tank, 2-hour detention time; aerobic digester; polishing pond; chlorination system; and two sludge drying beds. Operating results obtained indicate a water usage of about 7.6 gal per bird, with a BOD loading of about 39 lb per 1000 birds. Effluent from the final clarifer shows a 99% BOD removal with an average of 8 mg/l BOD and 98% suspended solids removal with an average of 10 mg/l. The effluent from the polishing pond averages 3 mg/l BOD with a dissolved oxygen average of about 8.0 mg/l. (Galwardi-Texas)
W70-07956

EFFECTS OF NITROGEN LIMITATION ON THE GROWTH AND COMPOSITION OF UNICELLULAR ALGAE IN CONTINUOUS CULTURE,
School of Aerospace Medicine, Brooks AFB, Tex.
B. Richardson, D. M. Orcutt, H. A. Schwertner, Cara L. Martinez, and Hazel E. Wickline.
Applied Microbiology, Vol 18, No 2, p 245-250, August 1969, 3 fig, 4 tab, 19 ref.

Descriptors: *Growth, *Algae, Lipids, Nutrients, Chlorella, Cultures.
Identifiers: *Fat accumulation, *Laboratory studies, *Nitrogen limitation, Batch cultures, Chlorella sorokiniana, Composition of algae, Continuous cultures, Fatty acids, Oocystis polymorpha, Unicellular algae.

Fat accumulation takes place in many algae as a response to exhaustion of the nitrogen supply and may provide a means of enchancing the potential food value of algae. Chemostatic continuous cultures of Chlorella sorokiniana and Oocystis polymorpha were subjected to successive reductions in influent nitrogen. As cellular nitrogen content decreased from about 10 to 4%, oxygen evolution, carbon dioxide uptake, chlorophyll content, and tissue production were drastically reduced, but total lipid content was essentially unchanged. In batch-cultured cells, nitrogen could be reduced to 3% of dry weight, causing an increase in total fatty acids and pronounced changes in the composition of the fatty acid fraction. These results suggest that cellular nitrogen must fall to about 3% of dry weight before appreciable increases in lipid synthesis can occur. All nitrogen is then apparently completely bound in essential cell constituents, and carbon subsequently fixed is converted into lipid products. Nitrogen limitation may be useful in increasing the food quality of batch-cultured cells, but the technique has little value for continuous culture systems per se. (Aguirre-Texas)
W70-07957

WATER AND EFFLUENTS,
Society of Dyers and Colourists, London (England).
R. W. Moncrieff.
Textile Manufacturer, Vol 93, p 11-13, 1967.

Descriptors: *Effluents, *Surfactants, Waste water treatments.
Identifiers: *Effluent treatment, *Water consumption, Dyehouse wastes, Rinsing wastes, Textile mill wastes.

At a symposium sponsored by the Society of Dyers and Colourists (London), two papers dealt with textile wastes and treatment thereof: Surface Active Agents in Processes and Effluents, by W. V. Barnes and S. Dobson, and Treatment of Effluents, by A. H. Little. (1) On today's market, 300-400 commercial surfactants are available in the United Kingdom and 2,000 - 3,000 in the United States. Along with giving the main classes of Textile Surfactants, the authors listed ten considerations which would lead to a suitable choice: (a) Nature of fiber, type of sail, and kind of machine used, (b) Foaming present or not, (c) Hardness of water, (d) Stability in presence of acids alkalis and metal salts, (e) Compatability with dyestuff and finish, (f) Absorption characteristics, (g) Cost, (h) Physical form, (i) Activity at low concentration, and (j) Influence on effluents. (2) The treatment of effluents is inevitable in today's textile industry. The surfactant used has much to do with the treatment afforded. This treatment determines the waste's acceptability by sewage works and must be dealt with early. The author in answering a question about rubber latex in the effluent gave a use for the waste. He commented his company had allowed the latex to collect on pebbles used as a filter. When these pebbles were completely coated they were used for a new covering of the parking lot. (Robinson-North Carolina State)
W70-07959

RECENT PROGRESS IN TREATMENT OF TEXTILE WASTE WATERS,
Peter W. Sherwood.
Canadian Textile Journal, Vol 82, p 40-43, September 3, 1965. 1 fig, 1 tab.

Descriptors: *Textiles, *Waste water treatment, *Oil wastes, Acidity, Alkalinity, Salts, Organic acids, Phenols, Soaps, Suspended load, Turbidity, Sulphur compounds, Nitrogen compounds, Odor, Taste, Oxygen requirements, Flow separation, Turbulance, Centrifugal pumps, Condensors, Filtration, Hydrogen ion concentration, Toxicity, Hardness, Separation techniques, Phosphorous compounds, Chlorine.
Identifiers: *Oil-in-water emulsions, Biological growths, Gravity separators, Demulsification, Aluminum compounds, Hydrogen-fluorene compounds, Sodium hypochlorite.

A classification of aqueous contaminants arising from textile operations breaks down into these categories: oil, both free and emulsified; acid or alkaline solutions; inorganic salts; organic acids and phenols or soaps of these compounds; suspended solids that increase turbidity; and various phenolic, napthenic, and organic sulphur and nitrogen compounds, toxic to marine life and causing unpleasant odors and tastes in water. Many of these organic compounds have a high oxygen demand. Biological growths occur in some of these wastes. For decontamination of oil-containing separable waters, gravity separators are used, but oil-water emulsions require chemical or electrical demulsifications processes. Three flow systems, recirculation, split flow, and pressurized flow, were studied. Recirculation was not used, but the method adopted proved highly effective, especially when activated silica and alum were added. Heat, chemical, and electrical costs used to treat oil-water emulsions may be reduced by jointly treating the emulsions and chemical wastes. Turbulent flow, centrifugal pumps, barometric condensers, and steam syphons should be avoided whenever possible because they favor formation of emulsions. Filtration can break up some emulsions by removing the stabilizing solids. Chemical factors which must be considered in textile wastes are pH, taste and odor, oxygen demand, toxicity, hardness, and suspended solids. Particularly troublesome regarding taste and odor are phenolic compounds and nitrogen bases, but extractive methods can reduce their nuisance. Aluminum chloride and phosphoric acids should be neutralized and HF-containing tars and aqueous liquers must be given special attention. Liquid chlorine or sodium hypochlorite centrol bacteria growths. (Lonon-North Carolina State)
W70-07960

NEW PROCESS FOR THE TREATMENT OF EFFLUENTS IN THE TEXTILE INDUSTRY (IN GERMAN),
Heinrich Riemer.
Zietschrift fur die Gesamte Textil Industrie, Vol 64, No 4, p 299-304, 1962. 3 fig, 4 tab.

Descriptors: *Flocculation, *Aeration, *Effluents, Storage tanks, Surfactants, Organic compounds, Adsorption, Resins, Costs, Chemical precipitation, Treatment facilities, *Waste water treatment.
Identifiers: Impurities, Dyes, Surface skin, Residues, Plant layout.

A new process which dispenses with the need for a large storage vessel and is thus particularly recommended for industrial concerns in highly built-up areas consists in the addition of a flocculating agent to and intense aeration of the effluent with simultaneous pH adjustment. This precipitates solid and colloidal impurities as a surface skin which can be easily removed, while residues of dyes, surface-active agents, and organic compounds are removed by adsorption into artificial resins. Typical layouts for the treatment plant are shown and costs are discussed. (Livengood-North Carolina State)
W70-07961

DOW SURFPAC PILOT STUDY ON TEXTILE WASTE,
Crompton-Shenandoah Co., Inc., Waynesboro, Va.
Duane W. Snyder.
Purdue University Engineering Extension Department, Extension Series No 115, p 476-482, 1963. 5 fig, 2 tab, 2 ref.

Descriptors: *Biological treatment, *Biological oxygen demand, *Trickling filters, *Waste water treatment, Waste water (Pollution), Pilot plants, Lagoon.
Identifiers: *Textile mill wastes, Shenandoah River.

At the Waynesboro, Virginia, plant of Crompton-Shenandoah Co., Inc., manufacturing corduroys, velvets, and velveteens, measures have been taken to modify plant processes to reduce the strength of the waste waters, which are discharged to South river, a tributary of the Shenandoah River. In view of the need to reduce the BOD of the effluent still further, various treatment processes were investigated, and pilot-plant studies were made on biological filtration, using synthetic Surfpac medium; results are tabulated, showing that the process was stable to shock loadings and the BOD was reduced by at least 50 per cent. The data obtained have been used to design a full-scale treatment plant which will also have an equalization pond, to permit operation over a 7-day period, and a final sedimentation tank; this should increase the reduction in BOD to 60-70 per cent. (Livengood and Work-North Carolina State)
W70-07962

INDUSTRIAL WASTES FROM SCOURING RUG WOOLS AND THE REMOVAL OF DIELDRIN,
Wiedeman and Singleton, Atlanta, Ga.
Robert D. Wilroy.
Proceedings of the Industrial Waste Conference, 18th, 1964, p 413-417.

Descriptors: *Dieldrin, *Waste water treatment, Streams, Suspended load, Screens, Sedimentation, Waste storage, Rivers, Septic tanks, Sewage, Fish, Dewatering, Sludge, Inorganic compounds, Effluents, Biochemical oxygen demand, Waste treatment, Lagoons, Solid wastes, Insecticides, Aquatic environment, Sedimentation.
Identifiers: Wool, Grit, Grease, Insect resistance treatments, Dyeing, Dyes, Decomposition, Equalization, Sand beds, Carpet mill wastes, Dyestuffs, Dyehouse wastes, Wool scouring.

hen it was planned to construct a rug manufacring plant in southeast USA, detailed studies ere made on the composition of the waste waters, e condition of the receiving stream, and the best pe of treatment. The coarse heavy wool used in eaving rugs has a high concentration of grit and organic suspended solids and a low initial grease ontent. It was learned that the waste waters would so contain large amounts of dieldrin, used for oth-proofing the wool, and there would also be aste waters from the dyeing process. The treatent facilities constructed consisted of fine reens, a sedimentation tank, and a baffled ualization lagoon to provide a long detention eriod with automatic discharge of the effluent at a te proportional to the flow in the river. Waste aters from the dyeing process are discharged to a nall creek flowing into the river, except when the yeing processes are deep red and black dyes are to e dumped, when the waste water is deverted to the goon. Effluent from the septic tank treating sanary sewage is also discharged to the lagoon. lthough the lagoon was designed only for ualization, there is evidence that active anaeroic decomposition is occurring, with reductions in OD of 80-90 percent. The concentration of dielrin in the final effluent is about 0.25 mg./l, and hen diluted with river water this should be educed to 0.0005 mg./l, which is much less than ne mean tolerance limit for the fish in the river. ome difficulty was experienced in dewatering the ludge on the sand beds, since the very fine wool nd grease form an impervious layer on top of the and and excess water collects on top of this. At resent, the excess water is removed by pumping nd the sludge dries rapidly. A dewatering system is o be installed. (Livengood-North Carolina State)
W70-07963

IMPLE BIO-AERATION KILLS STRONG WASTES CHEAPLY,
Frances Ridgway.
Chemical Engineering, Vol 70, No 1, p 40-41, 963.

Descriptors: *Biochemical oxygen demand, *Microorganisms, *Costs, Textiles, Sewage, Setling basins, Starch, Desizing wastes, Waste water reatment.
dentifiers: Aeration, Non-toxic wastes, Baffles, *Textile mill wastes.

A new bio-aeration system, based on action of microorganisms in a one-stage, prolonged process, s helping textile mills remove up to 90 percent of biochemical oxygen demand from strong starch desizing wastes. Developed by R. H. Souther, Greensboro, North Carolina, the process has four major advantages: (1) lower operational cost, (2) elimination of primary settling tanks and anaerobic sludge digesters, (3) decreases in the adverse effect from variable flow, changes in pH, and shock organic loadings in treatment of sewage and nontoxic organic wastes, and (4) increased flexibility in the use of air to obtain desired effluent characteristics. Waste water passes through a bar screen and a measuring device into an aeration tank, then through baffles to a final settling tank, and finally over weirs to the receiving stream. Sludge is returned to the influent end of the aeration tank to obtain highest BOD efficiency. Operating costs average 0.6 cents per pound of BOD influent per day, about 33 percent less than the cost for a conventional treatment plant. (Dandridge-North Carolina State)
W70-07964

ECONOMICAL UTILIZATION OF CAUSTIC SODA IN COTTON BLEACHERIES,
Allied Chemical Corp., New York. Textile Section.
W. R. Steele.
American Dyestuff Reporter, Vol 51, No 1, p 29-30, 1962.

Descriptors: *Costs, Air pollution, *Filtration, Cotton, Dialysis, Waste water treatment.
Identifiers: *Caustic soda, Sodium hydroxide, *Bleaching wastes.

Procedures have been developed for increasing the quantity and concentration of recovered caustic soda liquor to permit reuse of the maximum amount of caustic soda without reconditioning. If the concentration of caustic used liquor is not too low, it can be evaporated, purified, and reused. Because impurities must be concentrated before evaporation, filtration is required. Sometimes, dialysis is necessary to reduce soluble impurity content. A caustic reutilization survey may show that, although collection, filtration, evaporation, dialyzation, and re-evaporation may be needed, annual cost savings may exceed 50 percent. Beneficial side effects such as increased yardage return and alleviation of water and air pollution may also be obtained. (Dandridge-North Carolina State)
W70-07965

TREATMENT OF TEXTILE WASTES IN AERATED LAGOONS,
O'Brien and Gere, Syracuse, N.Y.
Samuel W. Williams, Jr., and George A. Hutto, Jr.
Proceedings of the Industrial Waste Conference, 16th, 1962, p 518-529. 7 fig, 2 tab.

Descriptors: *Waste storage, *Aeration, *Pilot plants, Chemical precipitation, Filtration, Sedimentation, Coagulation, Biological treatment, Biochemical oxygen demand, Cotton, Sludge, Sewers, Foaming, Sprays, Waste water treatment.
Identifiers: *Textile mill wastes, *Dyehouse wastes, Man-made fibers, Anti-foaming agents. Dyeing, Finishing, Caustic recovery, Starch.

The authors describe pilot-plant studies on treatment of waste waters from two textile mills of Burlington Industries, Inc. The plant at Mooresville, North Carolina, is an integrated cotton textile mill; various process modifications were made to reduce the volume strength of the waste waters, including installation of a caustic recovery unit and use of CMC instead of starch. Pilot-plant studies on treatment of the waste waters by chemical coagulation, biological filtration, and lagooning showed that good results could be obtained in aerated lagoons, and full-scale plant is being constructed; it will consist of two aerated lagoons with detention periods of 48 hours, and two sedimentation lagoons with detention periods of 12 hours with provision for recirculation of effluent if required. Sludge from the lagoons will be discharged to the municipal sewers. Foaming in the aerated lagoons will be controlled by addition of antifoaming agents, but sprays can be installed later if required. The mill at Wake Forest, North Carolina, receives fabrics from other mills for dyeing and finishing. In view of the successful results obtained with the aerated lagoons at the Mooresville plants, similar pilot-plant lagoons have been constructed at Wake Forest and are giving good results, with reductions in BOD of 75-80 percent. (Livengood-North Carolina State)
W70-07966

PRECIPITATION OF DIRECT DYES AND ACID DYES BY IRON SALTS (IN JAPANESE),
H. Iida, and M. Endo.
English summary included. Kogyo Kwagaku Zasshi, Vol 70, p 403-404, 1967. 4 ref.

Descriptors: *Chemical precipitation, Sodium sulfate, Waste water treatment.
Identifiers: *Direct dyes, *Acid dyes, *Iron salts, Clarification, Dyehouse wastes, Ferric chloride, Ferrous sulfate, Dyestuffs.

In order to obtain basic data for the clarification of industrial waste water containing dye, 18 direct dyes and six acid dyes were precipitated from each aqueous solution by the addition of ferric chloride or ferrous sulfate, and the amounts of precipitated dyes was determined. From the results it was found that ferric chloride and ferrous sulfate were excellent for the precipitation of direct dye, but were not useful for acid dye. It was difficult to precipitate acid dyes from their aqueous solution containing sodium sulfate by the above method. (Livengood-North Carolina State)
W70-07967

THE EFFECT OF SURFACE-ACTIVE AGENTS ON THE BIOCHEMICAL PURIFICATION OF EFFLUENTS FROM TEXTILE MILLS (IN RUSSIAN),
S. V. Yakovler, Y. M. Laskov, and Yu-Lin Yo.
Vodosnabzhenie i Sanitarnaya Tekhnika, Vol 9, p 12-14, 1963.

Descriptors: *Effluents, Aerokic treatment, Cotton, BOD, Sewage treatment, Sulfite liquirs, *Water purification, Waste water treatment.
Identifiers: *Biochemical purification, Printing, Sulfite liquirs, Cotton mill wastes, *Textile printing plant wastes.

As a result of widespread use of surface-active agents in the textile industry, the effluents from textile mills contain 50-125 mg/l of such agents, and higher concentrations can be expected in the future. The effect of these on the biochemical purification of effluents was studied in laboratory models of aeration tanks. The experiments were conducted on effluents from a textile printing plant to which various amounts of the most widely used surfactants were added, and on effluents from a cotton mill, containing surfactants in a total concentration of 60-130 mg/l. As determined by the reduction of BOD and organic chemicals demand, the addition of 20 mg/l of sulfanoles had no significant effect on the biochemical purification process. Higher concentrations substantually reduced and purification efficiency. In experiments with the cotton-mill effluents, satisfactory purification was obtained when the effluents were diluted with 40-100 percent domestic sewage, the needed amount of the diluent being determined by the nature and concentration of I, their maximum permissible concentration for effective purification ranged from 35 to 70 mg/l. (Livengood and Dandridge-North Carolina State)
W70-07968

DIMETHYLFORMAMIDE IN BIOLOGICAL PURIFICATION OF WASTE WATER (IN GERMAN),
M. Thonke, and W. Dittmann.
Fortschritte des Wasserchemie Ihre Grenzgebiete, Vol. 4, p272-277, 1966.

Descriptors: *Dimethylformamide, *Acrylic fibers, Activated sludge, *Wwaste water treatment, *Biological treatment.
Identifiers: Man-made fiber plant wastes, Solvents.

Dimethylformamide, present in the waste water from acrylic fiber production, is relatively quickly degraded by an activated sludge treatment and provides a source of carbon and nitrogen. (Livengood-North Carolina State)
W70-07969

THE SEWAGE TREATMENT PLANT AT NORDHORN (IN GERMAN),
D. Kehr, and P. Pflanz.
Gas- und Wasserfach, Vol. 7, p260-266, 1966.

Descriptors: *Activated sludge, *Sludge digestion, Pilot plants, Anaerobic digestion, Aerobic digestion, Biochemical oxygen demand, Solid wastes, Turbidity, Waste water treatment.
Identifiers: Permangenate demand, *Textile mill wastes.

An illustrated account of the design and operation of the activated-sludge plant at Nordhorn, Germany, designed for treatment of both sewage and textile industry waste waters. Extensive pilot-plant experiments carried out to prevent putrescible matter from inhibiting sludge digestion led to replacement of the anaerobic sludge digestion unit by a specially developed aerobic sludge-stabilization plant which is ordorless, less costly, and has proved most successful. Results showed removal of 70 percent of the permanganate demand and 93.5 percent of the 5-day BOD, leaving the effluent free from solids and reduced in turbidity. (C. Livengood - Robinson, North Carolina State)
W70-07970

AERATION, SETTLING, AND CHLORINATION OF THE COMBINED WASTE FROM A VISCOSE FIBER PLANT (IN RUSSIAN),
O. P. Sinev.
Trudy Novocherkasskogo Politeknicheskogo Instituta, Vol. 162, p33-43, 1966.

Descriptors: *Cellulose, *Textiles, Sludge disposal, Chlorination, Filtration, Flocculation, Aeration, Waste water treatment.
Identifiers: Hydrocellulose, *Rayon plant wastes, Zinc compounds, *Carbon disulfide.

Aeration of waste waters at a rate of 10-10.4 cu m/cu m waste water reduced the CS2 concentration from 41.6-82.3 to 5.2-9.0 mg/l., and H2S from 13.7-26 to 1.45-3.1 mg/l. Combined precipitation of suspended solids at pH > or = 10 gave intensive flocculation and precipitation of hydrocellulose and better conditions for extension of Zn (OH)2. Chlorination was most effective for a supplementary clarification after lime treatment and removal of suspended solids. The CL absorbability of the waste water after lime treatment, settling, and filtering through a sand filter was 46-73 mg/l. Residual CS2 and H2S concentrations in the waste waters at Cl2 doses equal to Cl absorbability were 5.3-12.9 and 0-7.1 mg/l., respectively. A preliminary aeration of the waste waters at pH < 3 considerably reduced Cl absorbability. Chlorination of aerated waste waters ensured complete oxidation of H2S and a decrease in CS2 concentration to 0.94-2.5 mg/l. and BOD to 32-60 mg/l. (Rhine-North Carolina State)
W70-07971

STUDIES ON THE TREATMENT OF WASTE WATERS FROM THE TEXTILE INDUSTRY (IN RUMANIAN),
E. Mambet, E. Cute, and L. Weiner.
Summaries in Russian, French and English. Studii de Protectia si Epurarea Apelor, Vol. 4, p307-332, 1962.

Descriptors: Cotton, Biochemical oxygen demand, Calcium chloride, *Waste water treatment.
Identifiers: *Dyehouse wastes, *Textile mill wastes, Wool scouring, Man-made fibers, Wool, Fabrics, Dyestuffs, Color.

Tests were conducted on the textile mill wastes which are most difficult to treat: those from the scouring of wool, spinning of natural silk, and finishing of fabrics containing cotton, wool, and man-made fibers. Data on the physico-chemical characteristics of the waste waters are reported in tables and graphs, and pilot-plant studies are described on possible methods of treatment of waste waters from the finishing of wool and man-made fibers. The wool finishing waste waters were generally alkaline, with a five-day BOD of 390-317.0 mg/l. and a highly variable color which disappeared at dilution between 1/5 and 1/500. With the finishing waste waters from man-made fibers, the color disappeared at dilutions between 1/7 and 1/10, the pH value was 6.5-9.0, and the five-day BOD was 85.0-130.0 mg/l. The best color removal, with simultaneous improvement of pH value, was obtained by treating the wool finishing waste waters with calcium chloride and aluminum sulfate in doses of 1.0-2.0 kg and .2 kg/cu m, respectively. These treatments also reduced the quantity of sludge produced by chemical treatment of the waste waters. After this treatment for color removal, waste waters resemble domestic sewage and can be treated biologically. (Work-North Carolina State)
W70-07973

INDUSTRIAL WASTES AND SALVAGE: CONSERVATION AND UTILIZATION,
C. H. Lipsett.
Atlas Publishing Company, New York, 1963, 2d Ed., 406 p.

Descriptors: *Dialysis, Sodium sulfate, Evaporation, Crystallization, Filtration, *Waste treatment.
Identifiers: *Caustic soda, *Rayon, *Dialysis, *Carbon disulfide, Viscose rayon, Man-made fiber plant wastes, Sodium hydroxide.

Except for Chapter 45 (p.258) the textile wastes referred to in this book consists of rags, threads, yarns and the like which are commercially salvageable. Caustic soda (sodium hydroxide) from the viscose rayon precipitating bath is recovered by dialysis, sodium sulfate is removed by vacuum evaporation followed by cooling, crystallization and filtration. Carbon disulfide in wash water is removed by vaporization before the waste water is discharged to the sewer. (Work-North Carolina State)
W70-07974

THE PURIFICATION OF WASTE WATER IN THE PRODUCTION OF POLYAMIDE-FIBER (IN GERMAN),
J. Kaeding.
Fortschritte der Wasserchemie und Ihrer Grenzgebiette, Vol. 5, p258-283, 1967. 13 ref.

Descriptors: *Biological treatment, *Chemical precipitation, Activated sludge, *Waste water treatment.
Identifiers: *Polyamides, Nylon-6, Man-Made fiber plant, Caprolactam.

Water from the production of nylon-6 was contaminated with organic substances, such as caprolactam oligomers, other by-products and detergents. Waste water purification by the activated sludge process was studied. Laboratory scale tests were carried out on a two-stage biological treatment followed by flocculation. The purification depended on the concentration of the influx and on the load. The conversion rate increased with the influx concentration. Holding time of 6 to 8 hours sufficed for the decomposition, with 30 deg C being better than at 20 deg C. The water containing only lactam was more readily purified than the waste water from the polymerization and the polyamide fiber production. The lactam was consumed by the micro organisms, so that only phosphates had to be added for microbial decomposition. Substances not easily biodegradable were removed from the waste water by absorption with coagulants such as aluminum sulfate, ferric chloride, ferrous sulfate and calcium hydroxide and the decomposition capacity was then approximately that of lactam-containing water. (Work-North Carolina State)
W70-07975

EXPERIENCE IN DECONTAMINATION OF EFFLUENTS FROM THE RODNIKOVSKY SPINNING MILL (IN RUSSIAN),
L. V. Krasovskii.
Gigiena i Sanitariya, Vol. 32, No. 7, p98-99, 1967.

Descriptors: *Coliforms, *Irradiation, Color, pH, Biochemical oxygen demand, *Chlorination, Chlorine, Waste water treatment.
Identifiers: *Textile mill wastes.

A table is given showing the change in color, pH, suspended solids and B.O.D. produced by a purification plant involving sand traps, settling basins, and aero-tanks. The coliforms required chlorination and a graph of residual chlorine vs. dosage is included. Promising reduction of coli-index and number of colonies were obtained with irradiation by using a low-pressure Ar-Hg lamp. The lamp was 55 mm. above the surface of the water, the depth was 75 mm., and the width of stream 140 mm. At 0.14 litters/seconds, this resulted in a 30-second exposure. (Work-North Carolina State)
W70-07976

WASTE WATER TREATMENT IN MODERN TEXTILE OPERATIONS (IN GERMAN),
H. F. Kuisel.
Oesterreichische-Abwasser-Rundschan, Vol. 11, No. 5, p80-84, 1966.

Descriptors: *Activated sludge, pH, Biochemical Oxygen Demand, Chlorine, *Legal aspects, Chemicals, Legislation, Color, Waste water treatment.
Identifiers: *Dyestuffs, *Textile mill wastes.

Utilization of Lake Constance as a drinking water reservoir, and an agreement between Austria, Germany and Switzerland, placed limitations on waste water discharged into the lake. The limitations suspended solids <0.3, organic solvents and extractable matter; by petroleum ether <10; B.O.D. <25; KMnO4 consumption <80 mg/liter, and absence of toxic matter; and temperature <30 deg. Activated sludge is poisoned by chemicals used in the textile industry (phenol, ureaformaldehyde, or mineral oils) as these are liberated in biological treatment. Collection and mixing of all effluents of a textile plant is a partial solution to this problem. Excess clorine decolorizes dyes in solution. The temperature can be controlled by a heat exchanger which also results in a fuel savings. The water is clearified and treated by activated sludge, to be used as an organic fertilizer. High pH and B.O.D. are reduced by aeration for 48 hours; hard detergents are to be excluded either by legislation or voluntarily. Phenol is to be removed in the plant by ion exchange, and may be recovered. Examples are given of treatment in various textile plants. (Work-North Carolina State)
W70-07977

DEVELOPMENT OF A METHOD FOR TREATING WASTE WATERS CONTAINING SULPHUR DYES FROM THE 'ASEN ZLATAROV' PLANT, ISKAR STATION, SOFIA (IN BULGARIAN),
Kh. Popov.
English Summary. Trudy Nauchnoizsledovatelskiya Institut Vodosnabzhenie Kanalizatsiya Sanitarnaya Tekhmika, Sofia, Vol. 2, p167-184, 1965.

Descriptors: *Chemical reactions, Chemical precipitation, Laboratory tests, *Waste water treatment.
Identifiers: *Sulfur dyes, *Dyehouse wastes, *Dyestuffs.

Laboratory tests showed that the most economical and effective method for the treatment of waste waters containing sulphur dyes was acidification with sulphuric acid to give a pH value of 3.5-4, followed by neutralization with lime to give a pH value of 8-8.5, the neutralization tanks being closed and slightly pressurized. The sulphur dioxide and hydrogen sulphide which are evolved react together and become harmless, and the treated waste water is suitable for discharge to the municipal sewer. Based on the results of the tests, which are given in tables and graphs, a treatment plant was designed and is shown diagrammatically. The pH value during acidification and neutralization will be controlled automatically. A period of 2-2.5 hours is required for sedimentation and 1-1.5 hours for neutralization. Alkaline sludge can be reused. (Work-North Carolina State)
W70-07978

TEXTILE WATER POLLUTION CLEANUP PICKS UP SPEED,
R. W. Pinault.
Textile World, Vol. 117, p52-66, 1967. 1 tab, 1 fig, 17 pictures.

Descriptors: *Cost Analysis, Lagoons, *Waste water treatment.
Identifiers: *Textile mill wastes, Dyeing, Fabric finishing, *Dyehouse wastes.

It is estimated that the textile industry will be required to spend $350 million dollars in the next 10 years to reduce the pollution from their plants to an acceptable level. For a plant dyeing and finishing 150 million yards of fabric a year, an added cost may be about one-tenth of a cent per yard. The operations of five plants are described. These are: (1) plant for the dyeing and bleaching of tricot

ric made from man-made fibers, (2) a plant ere color is removed by treating with lime and ting in a lagoon, (3) a plant where color was not roblem and uses aeration lagoons, (4) a printing d finishing plant using 9 to 10 million gallons of ter per day, and (5) a mill which can discharge waste water, after treatment, into a large fresh ter lake. (Work-North Carolina State)
70-07979

ATER POLLUTION ABATEMENT BY IM-OVED COAGULATION OF EFFLUENTS OM LYE-PEEL POTATO PROCESSING ANTS,
rth Dakota Water Resources Research Inst, Far-

ilford O. Fossum, and Albert M. Cooley.
ailable from the Clearinghouse as PB-192 632, .00 in paper copy, $0.65 in microfiche. Research oject Technical Completion Report, Water sources Research Institute WI221-006-70, Jan 70. 29 p, 12 tab, 7 fig, 3 ref. OWRR Project A-2-NDAK (1).

escriptors: Coagulant aids, *Coagulation/COD duction, Floc formation, Food processing wastes, eonardite, *Lye-peel waste, Neutralization of ste, *Polyelectrolyte use, *Potato processing stes.
entifiers: Coagulation, Sedimentation, Zeta tential, *Pollution abatement, Potatoes, Humic ids, *Waste water treatment.

e lye-peel process produces a waste from the eling stage which is very high in organic content d has a pH of 12 or more. This high alkalinity and e colloidal nature of the organic solids make their moval by coagulation very difficult. Leonardite is naturally-occurring material consisting of humic ids. It can be made colloidal in water and then ecipitated as a floc or gel. The possibility of using s floc to aid in removing the organic solids from e-peel waste is discussed. The addition of onardite to lye-peel waste in combination with her prime coagulants formed a dense settleable c. However, at high values of pH, the floc was in-fective as it actually resulted in increased COD lues for the supernatant liquor after two-hour ttling. At neutral or acidic pH values the onardite did assist in removal of solids. Even in ese cases, however, the supernatant was not clear t was dark-colored from the unprecipitated onardite. The addition of polyelectrolyte coagu-nt aids further improved the COD reduction. The tionic polyelectrolytes were considerable more fective than nonionic ones. Lowering of the pH natural fermentation instead of by acid addition d not materially alter the results.
70-07995

TATE OF THE ART REVIEW ON PRODUCT ECOVERY.
esource Engineering Associates, Wilton, Conn.

vailable from the Clearinghouse as PB-192 634, .00 in paper copy, $0.65 in microfiche. Water ollution Control Research Series, Nov 1969. 95 p, tab, 18 fig, 106 ref, 3 append. FWQA Project 7070 DJW--11/69, Contract No. 14-12-495.

escriptors: Waste water treatment, *Reviews, Waste treatment, Solid wastes, *Industrial wastes, quid wastes, *Byproducts.
entifiers: By-product recovery, *Recovery, Reuse, Product recovery, Industrial waste covery.

he recovery, reuse and sale of materials from quid effluents, or produced as a result of the treat-ent of liquid effluents is discussed. A critical view of literature up to date on product recovery major water use industries is presented. The conomical, technical and philosophical amework which determines the application of oduct recovery is presented wherever possible. his report does not cover water renovation for euse and product recovery from solid wastes. However, an evaluation of the utilization and product recovery of municipal sludge is presented. The principal areas of discussion are waste reduction practices including in-plant control, recovery techniques and practices, practical operating problems and the relationship between recovery and treatment. It is concluded that product recovery is an accepted practice with increasing usage; industry needs increasingly complex processes to develop optimum recovery schemes; by-product recovery results in a net cost to industry generally of a smaller magnitude than conventional treatment; and the situation is complicated by the tax exemption laws.
W70-07997

AEROBIC TREATMENT OF TEXTILE MILL WASTE,
E. L. Jones, T. A. Alspaugh, and H. B. Stokes.
Journal of the Water Pollution Control Federation, Vol 34, p 495-512, 1962.

Descriptors: *Aerobic treatment, *Activated sludge, *Contact stabilization, Biological treatment, Biochemical oxygen demand, Chlorination, *Waste water treatment.
Identifiers: *Textile mill wastes, Aerobic stabilization.

A full-scale, single-stage modification was made of the conventional activated sludge process to the contact stabilization process. The results of further pilot-plant studies on the biological treatment of textile waste waters in admixture with sewage at Greensboro, N.C. are given and discussed. Contact stabilization and prolonged aerobic stabilization modifications of the activated sludge process were investigated. The contact stabilization was found to give good results with mixtures in which about half the BOD load was contributed by textile wastes and reductions in BOD of 85-90% were obtained without chlorination; good color removals were also obtained. (Livengood-North Carolina State Univ)
W70-08133

PROBLEMS OF WASTE WATER DISPOSAL IN THE TEXTILE INDUSTRY (IN GERMAN),
M. Kehren.
Melliand Textilberichte, Vol 11, p 1274-1276 and Vol 12, p 1291-1395, 1963.

Descriptors: *Detergents, Waste water disposal, Sludge treatment, Waste water treatment.
Identifiers: *Turofloc process, Dyehouse wastes, Dyes, *Textile mill wastes, Biological purification, Clarification, Aluminum chloride, Synthetic resins, Sodium hydroxide.

The problem is discussed of detergents in effluent, in particular the limiting quantities which can interfere with biological purification systems. The recent Swiss Turofloc process is described. This can produce clarification and removal of dyestuffs and detergents by direct flotation by treatment with aluminum chloride. This is followed by sludge removal and clarification over a synthetic resin, which is regenerated with caustic soda. (Livengood-North Carolina State Univ)
W70-08134

DISPOSAL OF INDUSTRIAL WASTES AT MAITLAND, ONTARIO, WORKS OF DUPONT OF CANADA,
Du Pont of Canada Ltd., Maitland (Ontario).
R. F. Walker.
Proceeding of the Industrial Waste Conference, 12th, p 720-729, 1958. 4 fig, 3 tab, 3 ref.

Descriptors: *Chlorination, *Neutralization, *Chemical plant wastes, *Industrial wastes, Chemical wastes, St. Lawrence River, Waste disposal.
Identifiers: *Acrylic fibers, *Chemical plant wastes, Oil removal, Imhoff tank, Freon (TN), Orlon (TN).

The Maitland, Ontario, plant of DuPont of Canada Ltd., manufactures nylon intermediates, 'Freon' flourinated hydrocarbons, and 'Orlon' acrylic fibers. The sources and nature of the principal contaminants in the waste waters are shown in a table, together with a method of disposal. Combustible wastes are burned. Dilute chemical wastes are settled for removal of oil, neutralized if necessary, and discharged on the bed of the St. Lawrence River at a depth of 46 feet and a distance of 1,000 feet from the shore. Waste waters relatively free from contaminants are collected in an off-the-shore line. Sanitary wastes are digested in an Imhoff tank and chlorinated before discharges. (Livengood-North Carolina State Univ)
W70-08135

IRON TREATMENT OF WASTE WATERS CONTAINING DYES (IN GERMAN),
M. Kehren.
Berichte der Abwassertechnischen Vereinigung, No 8, p 219-227, 1957.

Descriptors: *Waste water treatment, *Industrial wastes, Cotton.
Identifiers: *Wool dyeing, *Cotton bleaching, *Cotton dyeing, *Iron, *Dyehouse wastes, *Iron salts, Composition, Bleaching, Wool dyes, Cotton dyes.

A table shows the composition of waste waters from the dyeing of wool and the bleaching and dyeing of cotton. The properties of the various types of dyes used are discussed. The results of investigations into the treatment of aqueous solutions of dyes with metallic iron and iron salts are given. (Livengood-North Carolina State Univ)
W70-08136

PROFITABLE USE OF WASTE MATERIALS IN COTTON MILLS,
Vasant Industrial and Engineering Works, Bombay (India).
V. S. Nathan.
Indian Textile Journal, Vol 64, p 763-764, 1954.

Descriptors: *Cotton, *Potassum compounds, Iron compounds, Waste water treatment, Industrial wastes.
Identifiers: *Textile mill wastes, Ferrous sulfate, Caustic soda, Tin compounds, *Alum, Lime, Chemical recovery.

Effluent waste water from the scouring and bleaching of cotton fabric can be treated with ferrons sulfate and air bubbled through it. Insoluble iron compounds settle out and after collection, the solids treated with sulfuric acid in order to recover fatty acids and iron sulfate. Potassium salts can be recovered from wool scouring wastes, in addition to the usual recovery of wool grease. The salts can be concentrated from the weighting of silk. Waste water from the mercerizing of cotton can be concentrated to recover the caustic in it after other impurities are removed by precipitation with alum or lime. (Work-North CarolinaState Univ)
W70-08137

DISPERSED GROWTH AERATION OF COTTON FINISHING WASTES. II. EFFECT OF HIGH pH AND LOWERED AIR RATE,
North Carolina State Univ., Raleigh.
N. L. Nemerow.
American Dyestuff Reporter, Vol 46, No 16, p 575-576, 1957. 1 tab, 1 ref.

Descriptors: *Biochemical Oxygen Demand, *Alkalinity, *Aeration, Cotton, *Cost analysis, Waste water treatment, Water pollution effects.
Identifiers: *Dyehouse wastes, Scouring, Mercerizing.

By reducing the amount of air and eliminating carbon dioxide used in the aeration and neutralization of highly alkaline waste water from a cotton scouring and mercerizing operation, a considerable dol-

lar saving was effected. But in so doing the reduction in the B.O.D. of the discharged water dropped from 71 percent to 33.6 percent. (Work-North Carolina State Univ)
W70-08138

THE CHEMICAL CONDITION OF WASTE WATERS FROM THE TEXTILE INDUSTRY (IN GERMAN),
M. Kehren.
Gas- und Wasserfech, Vol 99, p 544-545, 1958.

Descriptors: *Chemical properties, *Chemical precipitation, Alkalinity, Foaming, Waste water treatment.
Identifiers: *Textile mill wastes, Iron salts, Rinsing waters.

Alkaline rinsing water from the textile industry contains, in addition to comparatively easily removed fibrous and other insoluble matter, colloidally dissolved wetting and washing agents which cannot be biologically treated. Chemical precipitation with iron is the only successful method although foaming, which is comparatively harmless, cannot be completely avoided. (Livengood-North Carolina State Univ)
W70-08139

WOOL INDUSTRY WASTE WATERS (IN RUSSIAN),
J. Nowacki.
Gaz, Woda i Technika Sanitarna, No 3, p 65-90, 1956.

Descriptors: *Waste water treatment, *Waste water disposal, Waste waters, Coagulation, Lime.
Identifiers: *Wool dyeing, *Municipal sewers, *Sulfuric acid, *Ferric sulphate, Acid chrome dyes, Mordant dyes, Dyehouse wastes.

Laboratory experiments have been carried out at the Silesian Technological Institution on the preliminary treatment of waste waters from the wool industry before discharge to the municipal sewers. Waste waters containing acid chrome and metachrome dyes can be treated with H2SO4 and FeSO4 and mixed in an equalization tank with waste waters from the washing houses and with dye wastes previously treated with coagulation with lime and ferrous sulfate. Finally the mixed waste waters are settled before discharge. (Mattox-North Carolina State Univ)
W70-08140

POLLUTION CONTROL BY RECOVERY OF CAUSTIC SODA,
Solvay Process Div., Allied Chemical Corp., Syracuse, N.Y.
W. R. Steele.
American Dyestuff Reporter, Vol 44, No 12, p 400, 1955.

Descriptors: *Waste water treatment, Water pollution control.
Identifiers: *Caustic soda, *Recovery (Waste), *Textile mill wastes.

Eighty percent of caustic entering a bleachery operation is not consumed and can be recovered. The keys to recovery are washing out caustic on the tenter frame and increasing the concentration of caustic in wash liquors. Concentrated caustic solutions can be reused directly, and dilute solutions can be evaporated and concentrated for use in mercerization. High-purity caustic can also be removed. Efficient removal of caustic from cotton decreases shrinkage. (Sheffield-North Carolina State Univ)
W70-08143

BASIC STUDIES ON THE CLARIFICATION OF WASTE WATER CONTAINING DYES. I. PRECIPITATION OF DIRECT DYES BY FERRIC CHLORIDE,
H Iida, and N Kuwahara.
Representative Government Chemical Industries Research Institute, Tokyo, Vol 58, No 3, p 137-144, 1963.

Descriptors: *Chemical precipitation, Centrifugation, Sodium sulfate, *Waste water treatment.
Identifiers: *Flucculation, *Direct dyes, *Ferric chloride, Precipitation, Clarification, Dyehouse wastes, Dyestuffs.

In studies on the hetero flucculation of 5 direct dyes by ferric chloride from aqueous solutions, the precipitates were removed by centrifuging and the amount of unprecipitated dye was estimated colorimetrically. Precipitation was increased when the pH value was less than 5, and 95-100% of the dye was precipitated from a solution with 10 parts per million at pH 5 by the addition of 60-100 parts per million ferric chloride. Precipitation varied with the dye; some dyes precipitated in amounts less than 30% and others precipitated completely under the same conditions. With some dyes, precipitation was reduced by addition of sodium sulfate. (Robinson-North Carolina State Univ)
W70-08144

TREATMENT OF WOOL SCOURING LIQUORS,
E. W. Clark, and G. F. Kitchen.
Patent no. 1,029,114, May 11, 1965.

Descriptors: Flocculation, Filtration, Chemical precipitation, *Detergents, *Waste water treatment.
Identifiers: *Wool scouring, *Wool grease, *Ferrous sulfate, Sulfuric acid.

When synthetic detergents, rather than soap, are used to scour raw wool, it is quite difficult to separate the grease, suspended solids and dissolved solids from the waste water. A new and inexpensive method of so doing is based upon the use of ferrous sulfate (copperas). The preferred procedure is to treat the liquid with 0.2-1.5% of ferrous sulfate, blow with air at the boil, acidify with sulfuric acid to a pH of 1.0 to 4.0, boil for an hour, cool to room temperature and filter. By this process waste water containing about 2.0% wool grease, 3.5% total solids and possessing a 4 hour permanganate value of about 6000 p.p.m. can be reduced to 0.1%, 25 p.p.m. and about 3000 p.p.m., respectively. (Work-North CarolinaState Univ)
W70-08145

THE ECONOMICS OF BASE METAL RECOVERY BY ION EXCHANGE,
Permutit Company, Paramus, N.J.
A. B. Mindler.
Metallurgical Society Conferences, Vol 14, p 851-859, 1963. Science Publishers, New York, 1964.

Descriptors: *Waste water treatment, *Copper, Ion-Exchange, Copper compounds.
Identifiers: *Viscose rayon wastes, *Cuprammonium rayon plant wastes, *Zinc, Zinc compounds, Rayon plant wastes.

Waste waters from the manufacture of viscose rayon contain zinc which can be recovered by passing the water through cation exchange beds (Permutit Q) at a rate of 1 g.p.m. per cubic foot of bed. The solution eluted from the bed containing 12-14% zinc sulfate, is sent back to the process as make-up. Waste water from the manufacture of cuprammonium rayon, in the only plant in the United States, contains copper compounds in solution which is recovered by passing the solution through a bed of Zeo-Karb, a sulfonated coal. (Work-North Carolina State Univ)
W70-08146

ACTIVATED CARBON RECLAIMS TEXTILE INDUSTRY'S WASTE WATERS.

Environmental Science and Technology, 3, p 314-15, 1969.

Descriptors: *Water reuse, Waste water treatmen
*Reclaimed water, Textiles.
Identifiers: *Carpet mill wastes, *Textile mi
wastes, Carbon beds.

Process waste water from a carpet mill will b
passed through a moving carbon bed to remove im
purities so that the recovered water may be reuse
in plant operations. The amount and kind of impu
rities are not stated, nor is the composition of th
recovered water. (Work-North Carolina Stat
Univ)
W70-08148

5E. Ultimate Disposal of Wastes

WATER AND EFFLUENTS,
Society of Dyers and Colourists, London (En
gland).
For primary bibliographic entry see Field 05D.
W70-07959

STANZE V MEIER (INTERFERENCE WITH THE OPERATION OF DRAINS).
For primary bibliographic entry see Field 06E.
W70-08076

SYMPOSIUM ON WASTE-DISPOSAL PROBLEMS OF SOUTHERN MILLS,
American Association of Textile Chemists and Colorists, Durham, N.C.
For primary bibliographic entry see Field 05B.
W70-08141

5F. Water Treatment and Quality Alteration

SWAP CHEMICALS FOR CLEANER STREAMS,
Wesleyan Univ., Middletown, Conn.
For primary bibliographic entry see Field 05B.
W70-07972

ALGAE HANDLED EFFICIENTLY BY AUGUSTA WATER DISTRICT,
Augusta Water District, Maine.
Sidney S. Anthony.
Water and Sewage Works, Vol 116, p 185-189, 1969. 1 fig, 6 photos.

Descriptors: *Algae, *Maine, *Water supply, Copper sulfate, Reservoirs, Water pollution, Microorganisms, History, Taste, Odor, Deep wells, Water treatment, Mechanical equipment, Pumping plants, Maine.
Identifiers: *Augusta (Maine), Carleton Pond (Maine), Synura, Asterionella, Typhoid fever, Kennebec River (Maine), Cobbosseecontee Lake (Maine), Barge.

The history of the Augusta, Maine, water supply after 1870 is described. At that time the Kennebec River was used as the source of water; in the winter of 1902-1903 widespread typhoid fever outbreaks, traceable to the water supply, caused the inauguration of a water district. Carlton Pond, the principal reservoir, was chosen by the Augusta Water District and placed in operation in 1906. The pond, however, is subject to periodic infestations of algae, primarily Synura, with Asterionella also present. To alleviate the taste and odor problem caused by algae, control measures are taken. A special barge and pumps were developed for application of copper sulfate (the only chemical used) in dilution of 0.35 milligrams/liter. The treatment is completed in one day, in the fall, when water turbulence is minimal, and application is made to the entire lake and shoreline. One treatment is usually adequate to eliminate the algae. (Jones-Wisconsin)
W70-08096

LGAL REMOVAL IN UNIT PROCESSES,
vironmental Control Administration, Cincinnati, nio; and Iowa Univ, Iowa City. Dept. of Environental Health; and Iowa Univ., Iowa City. Dept. of vil Engineering.
onald R. Speedy, Neil B. Fisher, and Donald B. cDonald.
urnal American Water Works Association, Vol , p 289-292, 1969. 1 fig, 5 tab, 6 ref.

escriptors: *Algal control, *Potable water, anophyta, Sulfur bacteria, Color, Iron bacteria, ste, Filters, Iowa, Diatoms, Euglena, Chlaydomonas, Sampling, Scenedesmus, lorophyta, Chlorella, Chlorine, Lime, Coagulan.
entifiers: *Unit processes, Gastroenteritis, Synu- Anabaena, Iowa River, Cyclotella, Fragilaria, nedra, Navicula, Aphanizomenon, Oscillatoria, elosira, Actinastrum, Coelastrum, Pediastrum, estella, Stephanodiscus, Ankistrodesmus, loromonad, Alum.

determination of the efficiency of algal removal various unit operations of potable water treatent process was made. Samples were collected at rious locations throughout the treatment plant d examined to determine kinds and numbers of gal forms present. The results indicate a wide sparity in the efficiency of algal removal among e several unit processes studied. Numerous ornisms pass the filters into finished tap water; unts as high as 44 organisms/milliliter were obned. Cyclotella and Chlorella appear with the eatest frequency in the plant effluent. The use of um as a coagulant seems moderately effective for gal removal, but lime appears to be much more ficient due to formation of heavy floc which enps the cells upon settling. Both types of filters effct a high degree of algal removal at the start of a ter run; the sand continues to show fairly efficient moval until the head loss goes above six feet. The thrafilt filter shows a higher number of algae ssing through the filter. The importance of mainining a chlorine residual is shown by the number algae found in the finished tap water. (Jones-isconsin)
70-08107

HE ECONOMICS OF BASE METAL ECOVERY BY ION EXCHANGE,
ermutit Company, Paramus, N.J.
or primary bibliographic entry see Field 05D.
70-08146

OLOR IN INDUSTRIAL WASTES,
orth Carolina State Univ., Raleigh.
elson L. Nemerow.
urnal of the Sanitary Engineering Division. roceedings of the American Society of Civil Enneers, Vol 83, No SA1, February 1957, p 1180-1-180-14. 4 fig, 11 ref.

escriptors: *Chemical reactions, Color, Waste ater treatment.
entifiers: *Dyestuffs, Textile plant wastes, yehouse wastes.

is estimated that about 25 million pounds per ar of dyestuffs are discharged in the waste water om the dyeing of textiles and paper. The chemical mposition of dyestuffs, classified as nitroso, tro, azo, triphenzlmethane, anthroquinone, sulfur id heterocyclic are illustrated with examples. It is roposed that the color of such materials can be duced by appropriate chemical reactions. As an ustration, a procedure is developed to alter the lor of methyl orange, an azo dye. (Work-North arolina State Univ)
70-08147

5G. Water Quality Control

ROGERS V BOND BROS (WELL POLLUTED BY NEARBY CREOSOTE PLANT).

279 Ky 239, 130 SW2d 22-24 (1939).

Descriptors: *Kentucky, *Artesian wells, *Water pollution, *Creosote, Soil contamination effects, Cities, Impaired water quality, Pollutants, Industrial wastes, Oily wastes, Groundwater, Water pollution effects, Water supply, Railroads, Legal aspects, Judicial decisions, Water law, Groundwater movement, Municipal water, Remedies, Damages, Potable water, Explosions, Land clearing, Wood preservatives (Pesticides).
Identifiers: *Negligence, *Nuisance.

Plaintiff owned an artesian well which was the local municipal water supply source. Over a period of years, a creosote plant was operated in the vicinity of the well location, first by a railroad company, then by defendant. After acquisition, defendant used dynamite to clear timber on the property. Shortly thereafter, plaintiff discovered his well was so polluted with creosote that the water was unfit for drinking. He brought suit alleging that the careless operation of the plant and the use of dynamite had caused the contamination of his well. The court first noted tha the doctrine of absolute liability for one who harbors harmful substances on his property did not apply in Kentucky, and that the nuisance doctrine required the showing of continuing harm rather than an isolated invasion of rights. In holding for the defendant, the court stated that the evidence pertaining to the source of the creosote in the well was insufficient for submission to the jury. The court pointed out that the creosote pollution could have been the product of railroad company negligence and that defendant could not be liable since he was not a joint tort-feasor. The court also noted other possible sources of the contamination and ruled that plaintiff failed to prove a cause of action against defendant. (Hubener-Florida)
W70-07719

USE OF ACTIVATED SILICAIN WATER FOR TEXTILE FINISHING,
Brookneal Mills, Va.
Frederic A. Prisley.
Journal of the American Water Works Association, Vol 49, Pt 1, No 4, April 1957, p 459-463. 1 fig, 2 ref.

Descriptors: Flocculation, Rivers, Turbidity, Alkalinity, Ammonium compounds, Neutralization, Chlorine, Filtration, Waste water treatment.
Identifiers: *Activated silica, Alum, Sodium carbonate, Backwashing, Dyehouse wastes.

Activated silica increases speed of formation of aluminum floc as well as size, density, and strength. It is used at the Brookneal Filter Plant, which supplies a dyeing and finishing plant and the town of Brookneal, Virginia. The water comes from the Falling River and is quite soft. The raw water is allowed to settle and is then treated with alum and soda ash. Warm weather produces no problems other than rapid changes in turbidity and alkalinity due to heavy runoffs. Colder weather introduces problems of low turbidity and colder water, necessitating a maximum rate of filter operation. A test using PQN Sol A (the silicate), known as the N-sol process, was run, adding the sol in the flash mixer, and proved highly successful. Ammonium sulfate was used as a neutralizing agent in the test, but in permanent operation the chlorine itself was used. Installation of piping and a chlorine-feeding manifold was the major task necessary to put the system into operation. Results have shown that frequency of backwash was reduced, dumping of basins rose from every three months to every four weeks, filter rates were significantly increased, some chlorine residuals remained, and very little service was needed on the silica generator. (Lonon-North Carolina State)
W70-07740

USE OF TAXES, SUBSIDIES, AND REGULATIONS FOR POLLUTION ABATEMENT,
Clemson Univ., S.C. Water Resources Research Inst.
Hugh H. Macaulay.
Available from the Clearinghouse as PB-192 631, $3.00 in paper copy, $0.65 in microfiche. Water Resources Research Institute, Clemson University, Report No. 16, June 1970. 81 p, 6 fig, 29 ref. OWRR Project B-004-SC (9).

Descriptors: *Equilibrium prices, *Economic justification, *Welfare (Economics), Compensation, Taxes, *Water pollution control, Water quality, Regulation.
Identifiers: *Charges, *Subsidies, *Externalities.

The Knight and Coase articles on social costs (see W69-07188) are examined in the light of their relevance to water pollution. These articles emphasize the two-way nature of social costs that can be seen in congestion of highways. A mathematical presentation shows that the market solution of congestion is also Pareto-optimal. Forces that affect upstream and downstream costs are shown graphically and the optimal use of water quality derived. The presentation stresses the role of alternative opportunities and the public goods nature of water quality. A comparison of charges, subsidies, and regulations, shows that the latter two will result in an overdemand for stream quality. Charges are not subject to this defect. Externalities associated with water pollution are shown to conform to the Knight and Coase conditions; both upstream firms and downstream residents create external diseconomies for each other. As a consequence, the measures proposed for pollution abatement should be applied to all parties along the stream. The Buchanan, Stubblebein, Turvey argument that a charge must be coupled with a subsidy is shown to be inappropriate when all parties are charged for external diseconomies they create, or subsidized for those they forego. The relationship between pecuniary and technological externalities is discussed.
W70-07802

DESIGN AND OPERATION OF LARGE DESALTING PLANTS,
For primary bibliographic entry see Field 03A.
W70-07854

PHOTOSYNTHESIS AND OXYGEN BALANCE IN STREAMS,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
Donald J. O'Connor, and Dominic M. Di Toro.
Proceedings, American Society of Civil Engineers, J of the Sanit Eng Div, Vol 96, No SA2, Proc Paper 7240, p 547-571, April 1970. 25 p, 8 fig, 3 tab, 30 ref, 4 append.

Descriptors: *Mathematical studies, *Dissolved oxygen, *Photosynthetic oxygen, *Biochemical oxygen demand, *Time, Spatial distribution, Rivers, Streams, Steady flow, Temperature.
Identifiers: Algal oxygen source, Equation.

The equation expressing the dissolved oxygen balance in a flowing stream was mathematically formulated to include a time varying photosynthetic oxygen source. The solution to the equation was compared to diurnal dissolved oxygen data obtained from five streams for which the algal oxygen source was the primary cause of the diurnal dissolved oxygen fluctuation. A review of previous work was given and the theory used was presented. The importance of the nitrogenous component of BOD was also evident. The resulting agreement between the theoretical solution and the data indicated that the equation presented was an adequate representation of the dissolved oxygen balance in a time varying as well as spatially varying situation. The five rivers selected for analysis were the Grand River, the Clinton River, and the Flint River in Michigan; the Truckee River in Nevada, and the Ivel River in Great Britain. The data available was obtained during periods when a reasonable

approximation of a steady-state flow and temperature prevailed. Fourier analysis of photosynthetic oxygen source and time varying deficit of DO were described in the appendices. (Kriss-Cornell)
W70-07857

MASONITE CORP V STEEDE (RELATIVE RIGHTS OF WATER USE AND DAMAGES FOR INDUSTRIAL POLLUTION).

23 So 2d 756-760 (Miss 1945).

Descriptors: *Mississippi, *Fishkill, *Competing uses, *Damages, Colloids, Effluents, Water pollution sources, Industrial wastes, Pulp wastes, Organic matter, Organic wastes, Path of pollutants, Pollutants, Water pollution effects, Riparian rights, Navigable waters, Relative rights, Riparian waters, Watercourses (Legal), Industrial plants, Judicial decisions, Legal aspects.

Plaintiff sought damages for the destruction of her business, a fishing resort on a navigable river. The destruction was allegedly the result of effluent which defendant corporation allowed to escape into the river. The court held that plaintiff and others who could gain access to the river had the right to take fish therefrom. Plaintiff had the right to control access to the river via her property. The court stated that damages were recoverable, for the destruction of these rights, and the related right to profit from business. The jury was warranted in finding that defendant's action materially contributed to, if not solely caused, the destruction of plaintiff's business. The court found, however, that plaintiff had not proved with reasonable certainty any loss of profits or damages, but went on to say that she was entitled to actual damages if she could prove them, and nominal damages if she could not. Furthermore, defendant could be held liable only for its proportionate share of the damage inflicted. (Price-Florida)
W70-07950

WATER POLLUTION ABATEMENT BY IMPROVED COAGULATION OF EFFLUENTS FROM LYE-PEEL POTATO PROCESSING PLANTS,
North Dakota Water Resources Research Inst, Fargo.
For primary bibliographic entry see Field 05D.
W70-07995

ULTRASONIC EMULSIFICATION OF OIL TANKER CARGO, FEASIBILITY STUDY USING AN ULTRASONIC PROCESS TO EMULSIFY PETROLEUM TO REDUCE OIL SLICK HAZARDS IN EVENT OF SPILLAGE AT SEA.
Sonics International, Inc., Dallas, Tex.

Available from the Clearinghouse as PB-192 633, $3.00 in paper copy, $0.65 in microfiche. Water Pollution Control Research Series, Apr 1970. 164 p, 58 tab, 86 fig. FWQA Program 15080-DJQ 04/70.

Descriptors: Toxicity, Tanker, *Water Pollution Control, *Emulsions Safety, Evaluation, Costs, *Emulsifiers, *Dispersion, *Oil spills, Oily water, Oil-water interfaces.
Identifiers: Continuous process, Ultrasonics, Transportation, Flammability, Tanker.

The purpose of this project was to study the feasibility of producing emulsified oil at a rate comparable with conventional tanker loading rates and to investigate the economic and ecological factors. To determine blender parameters and emulsified oil characteristics, two crude oils and one fuel oil were chosen. A Libyan light oil, a Venezuelan oil and No. 6 Fuel Oil were used. Only two emulsifiers were used and they were base-neutralized sulfonated nonionics. These are compatible with sea water and of low toxicity. The emulsions tested were oil-in-water. Oil was the internal phase and 97% of the total. Water and chemical was the external phase and 3% of the total. The tests on the emulsions were to determine: stability under simulated transportation conditions, dispersibility in sea water, toxicity to fish, and product alteration. Included were tests with safety aspects: evaporation rates, flash points, vapor pressures and rupture leak tests. An economic study was made which shows emulsification costs of about 20 cents per barrel without considering possible offsets or side benefits.
W70-07996

FAIRWOOD BLUFFS CONSERVANCY DISTRICT V IMEL (DISCHARGE OF RAW SEWAGE INTO OPEN DITCH).

255 NE2d 674-684 (Ind Ct App 1970).

Descriptors: *Indiana, *Sewage, *Easements, *Waste disposal, Cities, Right-of-way, Municipal wastes, Sewage districts, Water pollution sources, Sewage treatment, Ditches, Sewage disposal, Local governments, Waste water (Pollution), Damages, Erosion, Environmental effects, Bank eerosion, Judicial decisions, Legal aspects, Remedies.

Defendant water conservancy district obtained an easement across plaintiffs' property for construction of an enclosed sanitary sewer and an open ditch to carry storm water. The conservancy district promised that the storm water drain would never carry raw sewage or excessive quantities of water. Subsequently, large quantities of water were directed throught the storm drainage ditch causing erosion of its banks. Raw sewage was also conveyed through the open ditch and plaintiffs were forced to abandon their home. In this action plaintiffs sought damages for nuisance, an injunction for its abatement, and cancellation of the easement. The appellate court affirmed the trial court's granting of damages, holding that the district was liable for damages in a civil action, as would be a municipal corporation, for creating and maintaining a nuisance by discharging raw sewage onto plaintiffs' land. (Hubener-Florida)
W70-07998

GRIGSBY V BD EDUC OF FLOYD COUNTY (CONSTRUCTION OF SEWAGE PLANT UPSTREAM FROM MUNICIPALITY).
542 SW2d 827-838 (Ky 1970).

Descriptors: *Kentucky, *Sewage treatment, *Municipal water, *Treatment facilities, Local governments, Water pollution, Waste treatment, Legislation, Administration, Water pollution control, Effluents, Public health, Water supply, Reasonable use, Water quality, Administrative agencies, Streams, Potable water, Adjudication procedure, Remedies, Sewage disposal, Sewage, Judicial decisions.

Defendant board of education obtained approval from the state Water Pollution Control Commission for a sewage-disposal system to be used in connection with a new high school situated on a certain creek. Plaintiffs, representing the citizens of a town downstream, sought to prevent construction of the disposal system alleging it would pollute the stream which furnished their public water supply. The court, pointing to substantial evidence indicating that the plant would adequately fulfill its purpose without causing pollution, held for defendants. The court stated that in such circumstances its scope of review was limited as to whether the action of the Commission was arbitrary, capricious or unreasonable. Since the action of the Commission was supported by substantial evidence, the court refused to overturn it. (Hubener-Florida)
W70-08003

DAHLSTROM V CITY OF WHITEHALL (MUNICIPAL REGULATION OF INDUSTRIAL SEWAGE DISCHARGE).
14 Mich App 349, 165 NW 2d 443-445 (1969).

Descriptors: *Michigan, *Sewers, *Local governments, *Regulation, Taxes, Legal aspects, Judicial decisions, Legislation, Sewage disposal, Outlets, Sanitary engineering, Municipal wastes, Administration, Planning, Industrial wastes, Industries.

Plaintiff taxpayer brought an action to have a amendment to one of defendant's city ordinance declared unconstitutional and an action for a wr of mandamus to compel the mayor of defendar city to require Genesco, a large business concern to connect its buildings to the city sewer system The ordinance before amendment required all r sidents with sewage to connect their sewer line wit a public sewer main if there was one within 100 fe of their property line. The ordinance was amende to require residents to connect if the buildings o their property were within 100 feet of a publi sewer main. Genesco's property abutted a publi sewer line but its buildings were more than 100 fe from a public sewer line. Plaintiff sought to sho that the amendment was passed solely to exemp Genesco from connecting with the city sewe system. The trial court held that plaintiff failed t state a cause of action. On appeal, the case was re manded because the trial court failed to state an reasons for its dismissal of the action; consequentl the appellate court could not rule whether or no the trial judge had abused his discretion i dismissing the action. (Barnett-Florida)
W70-08018

MASONITE CORP V STEEDE (RELATIV RIGHTS TO USE OF WATER--DAMAGE RESULTING FROM WATER POLLUTION).
21 So 2d 463-466 (Miss 1945).

Descriptors: *Mississippi, *Fishkill, *Competin uses, *Damages, Colloids, Effluents, Water pollu tion sources, Industrial wastes, Pulp wastes, Or ganic matter, Organic wastes, Path of pollutants Pollutants, Water pollution effects, Riparian rights Navigable waters, Relative rights, Watercourse (Legal), Industrial plants, Riparian waters, Judicia decisions, Legal aspects.

Plaintiff owned a fishing resort which was locate on a river into which fed a creek. The creek serve as a conveyance for wood fiber effluent from de fendant manufacturing plant. Plaintiff sued for los of business occasioned by said pollution. Plaintif received judgment at the trial court and defendan appealed. The court held that the plaintiff coul recover, if at all, only when it clearly appeared tha because of the killing of the fish the profits of plain tiff's business were less than they would have bee had the fish not been killed. That consequence wa not sufficiently shown so as to warrant a jury ver dict for plaintiff; consequently, defendant shoul have received a directed verdict below. (Price Florida)
W70-08019

ROSE V SOCONY-VACUUM CORI (NEGLIGENT POLLUTION OF GROUND WATER).
24 A2d 422-428 (R I 1942).

Descriptors: *Rhode Island, *Gasoline, *Percolat ing water, *Wells, Groundwater, Oily water, Oil in dustry, Water pollution sources, Groundwate movement, Underflow, Artesian wells, Streams, Ju dicial decisions, Pollution abatement, Potabl water, Standards, Water pollution effects, Impaire water quality, Percolation, Penetration, Diffusion Seepage, Hogs, Storage tanks, Water supply.
Identifiers: *Nuisance.

Plaintiff owned farmland on which he raised crop and pigs. Defendant owned a gas station on adjoin ing land. A break occurred in a pipeline to a tan on defendant's property and over 800,000 gallon of gas escaped into the ground. A year and a hal later plaintiff claimed gasoline appeared in the wel on his land. In an action for nuisance, plaintiff al leged that the gasoline had percolated in ground waters to plaintiff's premises, polluting his wate

pply and causing the deaths of his pigs. The court nd that the defendant was negligent in handling gasoline. However, in holding for the defen- nt, the court held the evidence insufficient to ablish that gasoline had entered plaintiff's well l stream or was the cause of death of the hogs. stimony that the water had the taste of gas, or an y appearance, was not sufficient to prove that gasoline spilled on defendant's ground had in- led plaintiff's water supply. Moreover, the dence tended to show that the groundwater pe from defendant's premises did not lead in the ection of plaintiff's well. (Hubener-Florida)
'0-08025

LDERSMA V MUSKEGON DEVELOPMENT (POLLUTION OF WATER SUPPLY BY OIL ELL ON ADJOINING LAND).

5 Mich 520, 282 NW 229-231 (1938).

scriptors: *Michigan, *Oil wastes, *Path of pol- ants, *Saline water intrusion, Water pollution, paired water quality, Pollutants, Industrial stes, Groundwater, Water pollution effects, gal aspects, Judicial decisions, Groundwater vement, Percolating water, Subsurface waters, fusion, Gravitational water, Salts, Saline soils, ste storage, Oil industry, Oil fields, Oil.

intiffs owned a 10 acre tract of farmland on ich they raised celery. Defendants operated an well on adjoining land and disposed of salt water l other drilling refuse by depositing it into a pit. intiffs brought action for damages alleging that deposits which appeared in their land and er supply, and which rendered plaintiffs' farm less for raising crops, came from defendants' The court found for defendant, holding insuffi- nt plaintiffs' evidence that the salt deposited on ir land was due to a subterranean flow of per- ating waters containing salt from defendants' The court noted the existence of other wells in vicinity and concluded that it was impossible to ermine that the direction of underground flow from the area of the defendants' pit to plaintiffs' d. (Hubener-Florida)
'0-08026

ABILITY FOR POLLUTION OF SUBTER- NEAN WATERS.
ALR2d 1265-1306 (1954).

scriptors: *Percolating water, *Water pollution, epage, *Subsurface waters, Prior appropria- n, Groundwater, Underground streams, Subsur- e runoff, Reasonable use, Damages, Surface ru- f, Gasoline, Water pollution sources, Mine ter, Oil wastes, Cesspools, Sewage disposal, mestic wastes, Farm wastes, Municipal wastes, tural gas, Saline water intrusion, Judicial deci- ns, Legal aspects, Mine acids, Deep percolation, ter pollution control.
ntifiers: Cemeteries.

nsidered herein is the liability in damages for, or enjoining of, the pollution of subterranean ers. A definitional section explains the terms d in the annotation. Various aspects of the ts and liabilities of parties who pollute subter- ean or percolating waters form the bulk of this k. Major cases in various jurisdictions are cited authority for the propositions presented in the y of the text. Generally, the areas considered : (1) liability for the pollution of waters whether colating or in subterranean streams; (2) the t to enjoin the continuance of an existing or a sible future pollution; (3) whether liability ex- under a charge of negligence or nuisance; (4) sources of pollution of subterranean waters in- ding refineries, cesspools, privies, oil and gas ks, saline intrusion, municipal wastes, manure, d animals and the like; and (5) injunctions inst the establishment of cemeteries if pollution kely to result. A distinction is made between the erican rule of reasonable use and the English e of absolute ownership. (See also W70-08050 W70-08051). (Barnett-Florida)
W70-08049

LIABILITY FOR POLLUTION OF SUBTERRANEAN WATERS (THE DISTINCTION BETWEEN SUBTERRANEAN STREAMS AND PERCOLATING WATERS).

38 ALR2d p 1269-1272 (1954)

Descriptors: *Percolating water, *Water pollution, *Seepage, *Subsurface waters, Groundwater, Underground streams, Subsurface runoff, Reasonable use, Prior appropriation, Water pollution sources, Judicial decisions, Legal aspects, Deep percolation.

With regard to liability for their pollution, a clear distinction is made between well-defined subterranean streams and percolating waters. The general rule is that the owner of land abutting on a surface stream may not pollute it to the injury of other ripparian owners. This same rule was found applicable in Rhode Island to subterranean streams following a well-defined course, but not so for waters passing by percolation or seepage. In Michigan, an inadvertent and non-negligent pollution of subterranean waters was held to be not actionable. The problem of differentiation between 'flow and seepage' is discussed with regard to liability for pollution of a well by seepage where a contrast was drawn only to impose liability for the flow of certain waters. (See also W70-08049 and W70-08051). (Barnett-Florida)
W70-08050

LIABILITY FOR POLLUTION OF SUBTERRANEAN WATERS (NEGLIGENCE FOR THE POLLUTION OF SUBTERRANEAN WATERS OR NUISANCE ACTIONS).
38 ALR2d 1265-1306, p 1285-1290 (1954).

Descriptors: *Percolating water, *Seepage, *Water pollution, *Subsurface waters, Deep percolation, Underground streams, Damages, Oil wells, Water pollution sources, Judicial decisions, Legal aspects, Remedies, Adjudication procedure.

The theories of negligence or nuisance are two grounds for the recovery of damages or for an injunction against the pollution of subterranean streams. Where it is found that the existence of a nuisance caused the pollution of subterranean waters, continuance of the nuisance may be enjoined or damages recovered. Examples of such nuisances are the improper burying of a cow, the improper location of a grave site, or the disposal of sewage so as to cause damage to the health or welfare of society. Two rules are used to impose liability for the pollution of subterranean waters. The American rule states that in the absence of negligence there is no liability if there was legitimate or a reasonable use of the defendant's property. The common law rule is that one must in all events so use his property as not to injure the legal rights of his neighbors. The different jurisdictions that adhere to either one or the other of these rules are listed. (See also W70-08049 and W70-08050). (Barnett-Florida)
W70-08051

RACINE V CATHOLIC BISHOP OF CHICAGO (STREAM POLLUTION AS A CONTINUING NUISANCE).
290 111 App 284, 8 NE2d 210-212 (1937).

Descriptors: *Illinois, *Water pollution, *Odor, *Sewage disposal, Streams, Sewage, Riparian rights, Surface waters, Judicial decisions, Legal aspects, Air pollution effects, Water pollution effects, Open channels, Damages, Water pollution sources, Remedies, Relative rights.
Identifiers: Nuisance (Continuing).

Plaintiff owned land which he subdivided for the purposes of sale. Defendant erected a seminary in the vicinity of this land. Plaintiff alleged that defendant allowed the sewage from the seminary buildings to flow into a creek that bordered plaintiff's land and thus filled the air with noxious odors, destroying plaintiff's business. The trial court directed a verdict for defendant. Plaintiff appealed, alleging a total loss of value in his land. Defendant contended that the alleged nuisance was a continuing nuisance, not a permanent one. The appellate court agreed and held that the pollution of a stream by sewage is a continuing nuisance and that judgments at law are held to afford compensation only for the injury sustained to the time of such judgment and not for future damages. Since the record failed to show a proper allegation of damages by the plaintiffs, the trial court's judgment was affirmed. (Barnett-Florida)
W70-08056

SIMON V HUDSON COAL CO (DISCHARGE OF MINE DRAINAGE INTO DITCH).

350 Pa 82, 38 A2d 259-262 (1944).

Descriptors: *Pennsylvania, *Mine water, *Mine drainage, *Discharge (Water), Coal mines, Waste dumps, Mine waster, Ditches, Water release, Effluents, Streamflow, Waste dilution, Conduits, Drainage engineering, Banks, Overflow, Judicial decisions, Legal aspects, Relative rights.
Identifiers: *Negligence.

Plaintiff owned property through which ran a ditch that originated in defendant's coal mining area. Defendant discharged drainage water into the ditch at irregular intervals. Following one discharge that increased the depth of water in the ditch by three to six feet, plaintiff's son fell into the ditch and drowned. Plaintiff brought action for damages. Plaintiff contended defendant was negligent in discharging such quantities of water without giving notice to children near the watercourse. The court gave summary judgment for defendant, holding that he had a legal right to discharge water into the stream without any liability to lower owners so long as the banks of the ditch were not overflowd. The defendant was held not negligent for failing to provide warning since the child fell into the water after the level had been raised and since notice of the discharge would not have prevented the child from playing along the ditch. (Hubener-Florida)
W70-08060

COMMONWEALTH V DOUGHERTY (POLICY BEHIND LICENSING OF PLUMBERS).

40 A2d 902-904 (Pa 1945).

Descriptors: *Pennsylvania, *Plumbing, *Regulation, *Water quality control, Drainage, Industrial plants, Sewers, Pipes, Construction, Legal aspects, Industrial wastes, Legislation, Public health, Judicial decisions, Permits, Sewage, Drainage effects, Impaired water quality, Water pollution, Engineering structures.
Identifiers: Licenses.

Appellant steamfitters tapped a subsidiary water pipe which connected a city water main with tanks located in the factory where appellants were engaged in construction work. From these tanks, which contained mercury cyanide solution, water was drained into a nearby sewer. Appellants were charged and convicted of performing plumbing work without plumbers' licenses, in violation of the state plumbing code. Appellants maintained the statute in question was unconstitutional on the ground that the legislature arbitrarily invaded the personal property rights of the appellants and unnecessarily interfered with their personal liberty under the guise of proper police regulations. The appellate court, however, affirmed the convictions and held that the control of connections with the city's water pipes bears a vital relation to public health since improper connections could lead to a contaminated water supply and inadequate drainage facilities. Consequently, the statute was a valid exercise of the police power. (Finman-Florida)
W70-08063

COMMONWEALTH EX REL MCCORMICK V PHILADELPHIA AND R COAL AND IRON CO (POLLUTION OF RIVER BY COAL MINING OPERATION).

347 Pa 602, A2d 19-22 (1943).

Descriptors: *Pennsylvania, *Water pollution, *Coal mine wastes, *Pollution abatement, Rivers, Water pollution sources, Legal aspects, Judicial decisions, Industrial wastes, Sedimentation, Groundwater movement, Dredging, Municipal water, Cities, Relative rights, Mine drainage, Coal mines, Remedies, Mine wastes, Mining, Water supply.
Identifiers: *Injunction.

Defendant company carried on coal mining operations and permitted coal dirt and mine refuse to wash into and pollute a river which was the water supply of plaintiff city. In a prior action in 1907 the court had denied injunctive relief against defendant upon finding that it had begun to impound its wastes. However, the court did grant plaintiff leave to re-apply for any orders necessary to ensure abatement of the pollution. The contaminating mines were subsequently leased to other corporations whose activities caused pollution of the river. Plaintiff, along with other intervening cities, brought action pursuant to the 1907 decisions, sought to join defendant and its lessees, and applied for an injunctive order against the pollution of the river. Plaintiff also asked that defendants be ordered to pay the costs of dredging sediment deposited in the river by defendants' mining operations. The court held that the application for an injunction was not within the terms of the original decree and defendants were entitled to a trial. (Hubener-Florida)
W70-08067

APPLICATIONS OF FLUORESCENT TRACER TECHNIQUES IN POLLUTION CONTROL STUDIES,
Beak (T.W.) Consultants Ltd., Montreal (Quebec).
P. L. Timpany.
Pulp and Paper, Vol 71, No 7, T145-T148, 1970. 8 fig, 8 ref.

Descriptors: *Tracers, *Water pollution control, *Dye releases, Fluorometry, Mixing, Evaluation, Water measurement, Dispersion, Time, Pulp and paper industry, Surfaces, Effluents, Analysis, Stratification, Analytical techniques, Tagging, River flow, Flow rates, Dispersion, Data collections, Pulp wastes.
Identifiers: Dilution, Fluorescent dyes, Rhodamine WT, Newfoundland.

Fluorescent tracer techniques are efficient tools in water pollution control studies. Large or small quantities of water may be tagged by the techniques outlined to study water distribution under any flow or mixing conditions. All fluorescent tracers are temperature dependent and must be calibrated and analyzed at a constant temperature or adjusted to calibrated temperature. Rhodamine W T (Dupont) is recommended for most long term studies of surface waters or flow studies of concentrated waste effluents occurring in 5-day pulp and paper mill aerated lagoons. Valuable information can be obtained relatively easily for flow rates, time-of-travel, dispersion, dilution, mixing, stratification, short-circuiting, and stagnant volumes. It is especially significant in evaluating the effects of spills or accidental dumps of soluble pollutants on water users downstream from a particular outfall. The field of fluorometric analysis makes it possible to measure accurately and analyze natural and industrial hydraulic processes including those of protection against shock loading, effects of hydraulic short-circuiting or stratification, aerator mixing capabilities, and volumetric measurement of stagnant or dead areas. (Jones-Wisconsin)
W70-08100

SIMULATION MODELING OF THERMAL EFFLUENT IN AN IRRIGATION SYSTEM,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
D. E. Peterson, and R. T. Jaske.
AEC Research and Development Report, BNWL-1277, UC-70, Pacific Northwest Laboratories, Richland, Jan. 1970. 21 p, 11 fig.

Descriptors: *Temperature, *Canals, *Irrigation, Heat transfer, Meteorological data, Evaporation, Conduction, Radiation, Water pollution control, *Simulation.
Identifiers: *Thermal effluent, COLHEAT simulation system, Advected heat, Flow records.

Simulations of hourly average water temperatures along a 40 mile reach of the Phelps county canal of south-central Nebraska were carried out by utilizing moving means of hourly regional weather data as input to the COLHEAT computer program. The COLHEAT simulation model applied a heat budget to a given section of a river or canal. The water temperature for a section Tw is determined. The simulation of the addition of a 500% increase in heat rejection to the canal system indicated a large potential sink capability for future expansion of the system without extensive modifications of the simulated thermal history. The computed rates of heat transfer from the canal indicate overall coefficients as high as 700 BTU/ (day) (ft2) (deg F) compared to 100-200 BTU/ (day) (ft2) (deg F) for lakes and ponds. Neither benefits nor liabilities to agriculture resulted from water temperature modification. (Upadhyaya-Vanderbilt)
W70-08117

MASONITE CORP V DENNIS (BURDEN OF PROOF FOR POLLUTION DAMAGE).

168 So 613-616 (Miss 1936).

Descriptors: *Mississippi, *Riparian land, *Industrial wastes, *Wood wastes, Water pollution, Public health, Pollutants, Pollutant identification, Wastes, Effluents, Water pollution sources, Industrial plants, Judicial decisions, Legal aspects, Remedies, Regulation, Depreciation, Productivity, Fibers (Plant), Upstream, Discharge (Water), Damages, Deposition (Sediments), Fish kill, Property values.

Defendant's manufacturing plant discharged waste products, consisting primarily of wood fiber, at a point fifty miles upstream from plaintiff's land. Plaintiff alleged that as a result of such discharge a sediment, as well as large numbers of dead fish, were deposited on his land, thereby adversely affecting the land's productivity. Plaintiff brought action for damages for the depreciation in value of the land. Defendant maintained that the effluent from its plant alone could not have destroyed animal life in the stream but would have had to be joined by effluents from other nearby sources. Also, although defendant discharged a million or more gallons of water and wood fiber into the stream daily, the amount of wood fiber was infinitesimal as compared to the immense volume of water discharged. The court took notice of the fact that polluted water would purify itself within a reasonably short distance, and that fish within a short distance downstream from defendant's plant were not normally destroyed by the effluent therefrom. The court concluded that since there was also a great distance from defendant's plant to plaintiff's land, there was no evidence to establish defendant's liability to plaintiff. (Finman-Florida)
W70-08118

COTTON SLASHING WITH SYNTHETIC COMPOUNDS AS A MEANS TOWARD POLLUTION ABATEMENT,
Crompton-Shenandoah Co., Inc., Waynesboro, Va.
Duane W. Snyder.
American Dyestuff Reporter, Vol 44, No 12, p 382-384, 1955. 2 ref, 2 fig, 4 tab.

Descriptors: Waste water treatment, *Water pollution control, *Cotton.
Identifiers: *Desizing wastes, *Dyehouse wast*Substitution, Carboxymethyl-cellulose, Slashi Textile mill wastes, Desizing.

Desizing and dyeing wastes contribute about 8 of the BOD coming from plants that discha waste from wet processes directly into st streams. Process substitution can remove ab 59% of the BOD and eliminate the need for a tr ment plant without greatly changing net operat costs. High-purity carboxymethylcellulose is pra cal as a desizing chemical; lower solids add reduces slashing costs, and water requirements good desizing are lowered by 50%. Substitut mineral acids for acetic acid lowers dye-wastes p lution. The extent of substitution in the slash formula determines the degree of BOD reducti (Sheffield-North Carolina State Univ)
W70-08142

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

THE DEVELOPMENT OF A MODEL TO EVA UATE HYDROLOGIC RISK IN A WAT RESOURCE SYSTEM,
Battelle Memorial Inst., Richland, Wash.; Texas A and M Univ., College Station.
William L. Bathke, and R. J. Freund.
Water Resources Bulletin, Vol 5, No 1, p 53-March 1969. 9 p, 15 ref, 3 fig.

Descriptors: *Economic analysis, *Risks, *Wa supply, *Irrigation design, *Simulation analy *Probability, Prices, Floods, Benefits, Optimi tion, Reservoir, Water inflow, Hydrologic aspe Computers, Economics, Watersheds, Model s dies, Storage capacity, Stream flow, Co Economic evaluation, Water resource planni Operations research, Dynamic programming, rigation efficiency.
Identifiers: *Irrigation development, *Surf technology, Operational hydrology, Hydrolo risks.

A technique is described for analyzing a wa resource sytem whose inflow is highly variable. T use of this technique requires not only that mathematical model be developed of the physi hydrological and economic characteristics of water resource sytem under study, but also t there be an economic evaluation of the benefits the system, including full and partial water deli ries for irrigation development. Data from watershed in the South Concho River, Texas v used. A region of tolerable water shortages v computed and a three-dimensional economic l function derived. A response surface of net ben was then fitted to the resulting net benefits of various design combinations. Standard respo surface technology was used to derive the optim combinations for a desired irrigation developm level. (Murphy-Rutgers)
W70-07738

SCHEDULING IRRIGATIONS WITH COMP TERS,
Agricultural Research Service, Kimberly, Ida Snake River Research Center.
Marvin E. Jensen.
Journal of Soil and Water Conservation Vol 29, 5, p 193-195, September-October 1969. 3 p.

Descriptors: *Irrigation, *Cost, *Comput *Management, Climate, Statistics, Value, Data c lections, Rainfall, Soil analysis, Precipitati Farming, Optimization, Evaporation, Progra Data processing.
Identifiers: *Irrigation scheduling, *Time sharin

The author seeks to show how irrigation schedul using climate-crop-soil data and computers facilitate the tedious computations usually acco panied by field observations. This service, which

des the field work of experienced personnel, is wn to be an economically justified management vice which increases the management skills of farmer at a reasonable cost. The background of development is traced and the basic principles olved are explained. The cost of the service is nd to be a hinderance to its adaptation on small ns but posing no problem for large acreages. urphy-Rutgers)
0-07739

E ELEMENTS OF INPUT-OUTPUT ANALY-

st Virginia Univ., Morgantown. Regional earch Inst.
liam H. Miernyk.
v York, Random House, 1965. 156 p.

scriptors: *Input-output analysis, Leontief dels, Statistical methods, Economic, Industries, ecasting, Regional analysis.
ntifiers: *econometrics, *Input-output table, nsaction, Sectors, Technical coefficients, chases, Stability conditions, Multiplier analysis, ployment multiplier, Interregional analysis, velopment.

e author presents the essentials of input-output lysis in nonmathematical terms, although a cer- amount of arithmetic is used to illustrate vari- steps in the analysis. The book is concerned y with input-output analysis rather than with the istical problems involved in the construction of nput-output table. The last chapter of the book cusses the rudiments of input-output mathe- tics. Most of this book deals with a static, open ut-output model. This model is the type upon ch the 1947 tables for the United States were ed. Input-output analysis has been used exten- ly in the water area. For example, such a nique has been used in an analysis of western er resource development. In light of its promis- uses in the water area, this book will be of value he water researcher unfamiliar with input-out- analysis. (Loeb-Rutgers)
0-07742

CUNIARY AND TECHNOLOGICAL EXTER- LITY, FACTOR RENTS, AND SOCIAL STS,
shington Univ., Seattle.
an A. Worcester, Jr.
erican Economic Review, Vol 59, No 5, p 873- , December 1969. 4 fig, 1 tab, 23 ref.

scriptors: Rent, Welfare, Prices, Alternative ts, Marginal costs, Average costs, Competition, nand, Monopoly.
ntifiers: *Pecuniary externality, *Technological ernality, Externalities, Factor rents, Social costs, rginal products, Opportunity cost, Production ction, Monopsony.

his paper the author considers the effects of uniary and technological externalities in a classical analysis. The author concludes that all ernal effects are found in principle to be reduci- by correct input pricing to economies or dis- nomies. This holds for separable and non- arable externalities in production and for exter- ties viewed either in terms of specific firms or ong industries. Different industry structures duce optimal allocation either for technological or pecuniary externalities if the externalities are rnal to an industry and the firms therein use the e factor proportions. When these conditions do hold, only competitive structures and pecunia- externalities suffice to produce an optimum in absence of complicated combinations of taxes subsidies which require a wealth of accurate ailed data. This article may prove to be of in- st to the water researcher investigating the ef- s of externalities of water production. (Loeb- gers)
0-07743

MANAGEMENT'S NEW ROLE,
New York Univ., N.Y. Graduate School of Business Administration.
Peter F. Drucker.
Harvard Business Review, p 49-54, November-December 1969.

Descriptors: *Management.
Identifiers: Social responsibility, Science, Discipline, Economic development, Entrepreneurial innovation, Humanity.

The author reviews five assumptions that may have formed the foundation of the theory and practice of management in the last half century. These assumptions deal with the scope, the task, the position and the nature of management. These assumptions were: (1) Only business has 'social responsibility.' (2) Entrepreneurship and innovation lie outside the management scope. (3) It is managements' task to make the manual worker productive. (4) Management is a 'science' or at least a 'discipline.' (5) Management is the result of economic development. The author argues that many of these assumptions have become obsolete and formulates five new assumptions which correspond to the management realities of today. These new assumptions are (1) all institutions, including business, are accountable for the 'quality of life.' (2) Entrepreneurial innovation will become the core of management. (3) It is management's task to make knowledge more productive. (4) Management will have to be considered as both a 'science' and a 'humanity.' (5) Economic and social development are the result of management. The author contends that these new assumptions are better guides to effective management. This discussion would be helpful to the water manager who must use science and the natural environment in order to achieve water needs and maintain the quality of life. (Loeb-Rutgers)
W70-07745

DYNAMIC PROGRAMMING OF ECONOMIC DECISIONS,
Martin J. Beckmann.
New York, Springer-Verlag Inc, 1968. 143 p.

Descriptors: *Dynamic programming, Mathematical studies, Economics, Operations research, Technology, Sequence, Risks, Linear programming, Stability, Resource allocation, Constraints.
Identifiers: *Economic decisions, Mathematical theory, Discrete sequences, Continuous sequences, Continuous decision variables, Discrete decision variables, Certainty, Finite alternatives, Optimality, Value function, Machine care, Inventory control, Exponential weighting, Turnpike theorem, Sequential programming.

Dynamic programming is the analysis of multistage decision in the sequential mode. It is now widely recognized as a tool of versatility and power, and is applied to an increasing extent in all phases of economic analysis, operations research, technology, and also in mathematical theory itself. In this monograph the reader is introduced to the basic ideas of dynamic programming. An attempt is made to show the breadth of this method by a careful exposition of its principles followed by some typical applications to economic analysis, operations research and decisions making in general. Some effort has been made to give a systematic exposition of the various possibilities: discrete and continuous sequences; discrete and continuous decision variables; certainty, risk, and uncertainty. Dynamic programming has proven to be quite applicable in the water area for solving such problems as the optimal sequencing of water supply projects. (Loeb-Rutgers)
W70-07746

ON THE SOCIAL RATE OF DISCOUNT: COMMENT III,
California Univ., Berkeley.
Carl Landauer.
American Economic Review, Vol 59, No 5, p 917-918, December 1969. 6 ref.

Descriptors: Demand, Risks, Time.
Identifiers: *Social rate of discount, Time preference, Mission, Irreversibilities, Disproduct.

The author provides an additional argument of why the search for a unitary, optimal rate of social discount is futile. The author considers a factor which in historically important instances has increased the difference between private and public time preference in the minds of at least some members of a community. This factor is that of a sense of national mission requiring heavy present sacrifice for the sake of the future. The Tullock objection to this is discussed (i.e. that the next generation will be wealthier than us) as well as the counterarguments to this such as the impossibility of restoring the fertility of the soil or the beauty of the land once they have been destroyed. The author points out that some public investments have a close relationship to our private fortunes while others have a much looser relationship to our personal lives. These arguments would be directly applicable to the water area where a sense of national mission may be influential as a catalyst for water project investment decisions. (Loeb-Rutgers)
W70-07747

A GEOMETRIC TREATMENT OF AVERCH-JOHNSON'S BEHAVIOR OF THE FIRM MODEL,
Bell Telephone Lab., Inc.
E. E. Zajac.
American Economic Review Vol LX, No 1, p 117-125, March 1970.

Descriptors: *Model studies, *Cost minimization, *Rate of return, Capital, Profits, Management, Resource allocation, Economic efficiency, Prices, Technology.
Identifiers: *Firm regulation, *Social costs, Geometric analysis, Stockholders equity, Rate regulation.

The Averch-Johnson model of the regulated firm concluded that a profit-maximizing firm, regulated on fair rate of return, operates inefficiently in the sense that social cost is not minimized at the output selected and that the firm adjusts to the regulatory constraint by substituting capital for labor. Thus, regulated firms are driven to socially undesirable operations. This article gives a geometric analysis of the model and discusses its conclusions. The author examines the behavior of the firm and its regulators and replaces the profit maximization hypothesis is with that of maximizing rate of return on equity. An attempt is also made to model the effect of the labor constraints to which the firm is subject. The last section examines the rate base expansion by acquisition of nonproductive capital in order to show how it differs from the Averch-Johnson effect. The article has particular relevance for the water resource area where water utilities are subject to the regulatory process. (Murphy-Rutgers)
W70-07748

STRATEGY FOR FINANCIAL EMERGENCIES,
Harvard Univ., Boston, Mass. Graduate School of Business Administration.
Gordon Donaldson.
Harvard Business Review, p 67-79, Nov-Dec 1969. 2 charts, 1 ref.

Descriptors: *Risks, Financing, Model studies, Management, Computers.
Identifiers: *Financial emergencies, *Contingency planning, Contingency analysis, Inventory, Reserves, Strategy, Information system, Cash-flow computer model, Financial mobility.

Uncertainty has always been a part of business experience. However, current planning techniques and the philosophy of management by goals and objectives seem insensitive to unexpected change.

With business uncertainties increasing as the nation attempts to readjust its commitments abroad and solve major social and economic problems at home, the need for formal planning to cope with unexpected deficit in funds flow becomes important. In this article the author suggests three steps in a strategy for dealing with financial emergencies around which a new approach to the problem can be organized. The first step is to provide the company with an information system capable of analyzing data about the likely course of events in the future. The second step in contingency planning is the preparation of inventory of resources of financial mobility. The third step is the formulation of a strategy for dealing with the unknown. This approach might be quite helpful to the water planner whose investment decisions are often beset by the uncertainties of the political system. (Loeb-Rutgers)
W70-07749

ON THE SOCIAL RATE OF DISCOUNT: COMMENT V,
Queen's Univ., Kingston (Ontario).
Dan Usher.
American Economic Review, Vol 59, No 5, p 925-929, Dec 1969. 1 fig, 2 ref.

Descriptors: Interest, Risks, Taxes, Discount rate, Welfare.
Identifiers: *Social rate of discount, Consumption, Time preference, Opportunity cost.

Referring to Baumol's recent paper, the author contends that the choice of discount rate cannot be literally indeterminate if the correct rate can be found using the theory of the second best. Even when the rate of time preferences differs from the rate of opportunity cost in the private sector, an optimal rate of discount for the public sector is implied by the rules for maximizing the welfare of the community in the choice of public and private goods. Using the method developed by Lipsey and Lancaster the author shows how to choose the interest rate on government projects and proves that, under quite general assumptions, the appropriate interest rate on government projects lies between the rate of time preference and the rate of opportunity cost between present and future consumption in the private sector. This may prove valuable to the water researcher in light of the impact of interest rates on his investment decisions. (Loeb-Rutgers)
W70-07751

THE EXISTENCE OF AN OPTIMAL ECONOMIC POLICY,
California Univ., Berkeley; and Iowa State Univ., Ames.
T. Krishna Kumar.
Econometrica, Vol 37, No 4, p 600-610, Oct 1969. 21 ref.

Descriptors: Mathematical studies, Mathematical models, Economics, Linear programming.
Identifiers: *Optimal economic policy, Optimal policy, Planning horizon, Control variables, State variables, Optimal control, Helby's Theorem.

In its most general form an optimal economic policy is characterized as an optimal choice among alternative feasible time paths in transforming the economy from a given initial state to a desired final state at the end of a planning horizon. Since the mathematical description of the economy consists of variables, some of which are control variables, while the rest are the controlled variables or the state variables, the problem is analogous to the structure of optimal control policies. The question of the existence of optimal economic policies in dynamic models posed recently by Chakravarty and Yaari is examined here within a more general framework. In the particular case of a linear model, the problem can be shown to be equivalent to a continuous (or infinite) linear programming problem. The existence of optimal policy in this use is equivalent to the duality theorem for a continuous linear programming problem. This analysis would prove applicable to economic policy problems in the water area where a policy maker's welfare function, dependent upon the time paths of some specified state variables and instrument variables (constraints), is to be maximized. (Loeb-Rutgers)
W70-07752

ESTIMATION OF THE LINEAR EXPENDITURE SYSTEM,
Pennsylvania Univ., Philadelphia.
Robert A. Pollak, and Terence J. Wales.
Econometrica, Vol 37, No 4, p 611-628, Oct 1969. 4 tab, 3 append.

Descriptors: *Estimating, Expenditures, Demand, Economics, Statistical methods, Prices.
Identifiers: *Estimation, *Linear expenditure system, Maximum likelihood estimates, Consumption, Dynamic specification, Stochastic specification.

In this paper the authors estimate a complete system of demand equations making full use of the restrictions implied by economic theory. The theoretical model is based on the Klein-Rubin linear expenditure system which was first estimated by Stone. Primary emphasis is placed on maximum likelihood estimates obtained using annual time series observations of prices and per capita consumption for the U.S. economy in the period 1948-1965. The plan of the paper is as folows: Section 1 begins with a discussion of the problems involved in making systematic use of economic theory to estimate demand functions; this is followed by a brief description of the linear expenditure system and a discussion of the specification of its dynamic and stochastic structure. In section 2 three methods of estimating the linear expenditure system are described, including the maximum likelihood procedure which the authors believe to be most appropriate. The results are reported in Section 3 and conclusions in Section 4. This article would prove applicable to the water area when using econometric methods to estimate water demand equations.
W70-07755

DESIGN AND CONSTRUCTION OF THE WORLD'S LARGEST FLASH TYPE DESALTING PLANT AT TIJUANA, MEXICO,
For primary bibliographic entry see Field 03A.
W70-07765

UTILIZATION OF PHYSICAL AND MATHEMATICAL MODELS IN MARINE WATER RESOURCES RESEARCH, PLANNING AND MANAGEMENT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02L.
W70-07801

METHODS SYSTEMIZATION MANUAL: PREPARATION OF HYDROLOGIC ENGINEERING COMPUTER PROGRAMS.
Corps of Engineers, Sacramento, Calif. Hydrologic Engineering Center.
For primary bibliographic entry see Field 08B.
W70-07853

ENGINEER VERSUS COMPUTER - A STRATEGY OF PERSUASION,
California State Div. of Highways, Sacramento.
Earl Rogers.
Proceedings, American Society of Civil Engineers, Journal of Professional Activities, Vol 95, No PP1, Proc Paper 6654, p 9-15, July 1969. 7 p.

Descriptors: *Computers, *Engineers, Attitudes, Motivation.
Identifiers: Persuasion, Programmers.

Although engineering staffs have daily exposure to computers, little thought process is devoted to its imaginative or innovative use. Specific points of sistance, reasons why the growth of computer stallation can induce or prolong resistance, a suggested ways to dissolve resistance are cit Points of resistance included the engineers satisf tion in doing their own calculations, the time f tor, limits of computer programs and their co plexity. One of the problems of growth included question of using engineer-programmers or non gineer programmers. It was stated that engineer organizations should place an engineer in charge its computer installation. In this case engine must be educated as to the worth of their compu and it must be kept close to them. A three-m team approach was suggested for development o new engineering system. It consisted of the gineer-use, the engineer-computer specialist a the engineering computer programmer. As an ample, the development of a highway drain analysis system was described. (Kriss-Cornell)
W70-07855

PHOTOSYNTHESIS AND OXYGEN BALAN IN STREAMS,
Manhattan Coll., Bronx, N.Y. Dept. of Civil E gineering.
For primary bibliographic entry see Field 05G.
W70-07857

ON OPTIMIZATION METHODS FO BRANCHING MULTISTAGE WATE RESOURCE SYSTEMS,
Montana State Univ., Bozeman.
Oscar R. Burt.
Water Resources Research, Vol 6, No 1, p 34 346, Feb 1970. 2 p, 8 ref.

Descriptors: *Optimization, *Linear programmi *Dynamic programming, *Constraints, *Wa resources.
Identifiers: *Nonlinear programming, Branching

Presentation of linear and nonlinear programi models and dynamic programing models for app cation to branching multistate systems was the p mary objective of the letter written in reference a recent paper by Meier and Beightler and su sequent discussions between Loucks and Meier a Beightler. The positions taken by the men me tioned ruled out the use of linear programing (a nonlinear programing) jointly with dynamic p graming within the same optimization scheme. was noted that the class of problems considered Meier and Beightler had the following properti (1) additivity in the criterion function, (2) linear in the constraints, and (3) essentially the so-call angular form in the constraint equations. It seem surprising that the Dantzig-Wolfe decompositi was not mentioned by Loucks or Meier a Beightler, since it was so applicable to proble with the three properties listed. The first two pr perties were ruled out by the author and the thi dynamic programing was considered. It was stat that recurrence relation of dynamic programi permits recursive optimization stage by stage, a there is nothing to prevent the use of linear or no linear programing in the optimization of each sta The virtues and advantages of the meth described were apparent to the author. (Kriss-C nell)
W70-07859

OPTIMIZATION OF BASIC PARAMETERS O THERMAL DESALTING PLANTS WI ADIABATIC EVAPORATION,
For primary bibliographic entry see Field 03A.
W70-07860

OPTIMIZATION OF A REVERSE OSMOS SYSTEM USING NONLINEAR PR GRAMMING,
California Univ., Los Angeles. Graduate School Business Administration.
G. B. Hatfield, and Glenn W. Graves.
Desalination, Vol 7, No 2, p 147-177, Feb 1970. p, 2 fig, 6 tab, 18 ref, append.

scriptors: *Optimization, *Mathematical dels, *Desalination, Brackish water, *Reverse nosis, Computer programs, Costs.
ntifiers: *Nonlinear programming, *Coalinga ot Plant, Parameters.

mathematical model of a large tube reverse os- sis system for desalination of brackish water was veloped. The system was said to be similar to the ular assemblies of the Coalinga Pilot Plant scribed. Performance equations of a tubular as- bly developed by Rosenfeld and Lieb were sented. Then a mathematical model charac- izing a series of assemblies where the output m the first assembly is the input to the second, . was built. The parameters of pressure, flow e, salt concentration, tube length and diameter, d brine temperature characterizing the Coalinga nt were used with the performance equations to ermine the product flux and the product salt ncentration. The results were compared with ac- l operating curves from the Coalinga Plant to ermine the validity of the mathematical model d the performance equations. A nonlinear pro- mming problem was formulated with the objec- e of maximizing product flux and determining optimal arrangement of assemblies with respect fabrication temperature and was run on the IBM stem 360 Model 75 computer at UCLA. The ution of the problem pointed out that by using dern computing machines and optimization hniques substantial gains can be made in reduc- the size of reverse osmosis systems and thus ducing the cost of the water produced. (Kriss- rnell)
70-07861

IENTIFIC METHOD - A TRIAD,
ami Univ., Coral Gables, Fla.
rray I. Mantell.
ceedings, American Society of Civil Engineers, rnal of Professional Activities, Vol 95, No PP1, c Paper 6676, p 47-53, July 1969. 7 p, 3 fig, 1 , 5 ref, append.

scriptors: *Systems analysis, *Design, *Opera- ns research, *Engineering.
ntifiers: *Scientific method, Basic research, Ap- ed research, *Flow charts.

e thesis that the scientific method may generally applied to all types of problems, and that where method appears inapplicable it appears thus cause of application of the wrong pattern of the entific method's triad of patterns of problem ving, was presented. The three patterns within scientific method were entitled: (1) Basic search; (2) Applied Research; and (3) Systems proach and details of each were presented. A w chart sequence of steps involved in an efficient proach to basic research was shown. The key p shown is the process of induction in which a ory or principle is derived. A second flow chart monstrated the pattern of problem solving in ap- ed research. The most significant difference tween patterns of problem solving in basic and plied research was said to be in the types of as- mptions used. For the pattern characteristically ed in solving individual problems directly ap- cable to man's needs and desires, the systems ap- ach was described in a third flow chart. The ior differences between all three patterns of blem solving were summarized. (Kriss-Cornell)
70-07863

MPUTER MODELING TECHNIQUES FOR VIRONMENTAL SYSTEMS,
lytechnic Inst. of Brooklyn, N.Y. Center for ban Environmental Studies.
ul R. DeCicco, and Richard Slutzah.
w York State Science and Technology Founda- n Report, Dec 1969. 172 p, 63 fig, 7 ref. Grant SSF (8)-1.

scriptors: *Computer programs, *Data cessing, *Input-output analysis, *Waste water atment, *Sewers, Design, Costs.

Identifiers: *Heuristic networks, Demographics, Topographics, Potential links, Digitizer, Nassau County.

The principal effort of the study was the development of a computerized heuristic technique for the layout of waste water collection systems. The general approach was predicted on the availability of a series of computer programs for testing by designing and costing the heuristic networks developed. A system was constructed for the consideration of demographic, topographic, and service characteristic information in the generation of 'Potential Links' for the area to be designed. The trial network was then developed by establishing each final link in accordance with priority ratings based on a number of weighted criteria. The system contained 32 routines including five major routines for defining the network, and ten special routines for determining the elevation at any point, the assignment of street code information, rating of how well each link satisfied the service requirement, and for performing a number of other functions which convert the trial network into a practical layout. The remaining routines were for sorting and ordering data, for printing tables and for performing special operations, such as reversing flow direction of a link, correcting service ratings, and printing error and other messages. A system was developed using an electronic x-y digitizer for input data. The possible use of mark-sense input techniques was also considered and described. A detailed design and cost estimating program and an evaluation of the heuristic network procedure based upon the output program was given. The street model used was in Nassau County. (Kriss-Cornell)
W70-07864

OPTIMUM OPERATION OF DESALTING PLANTS AS A SUPPLEMENTAL SOURCE OF SAFE YIELD,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 03A.
W70-07865

SIMULATION AND HYDROLOGIC RESPONSE OF A DRAINAGE NET OF A SMALL AGRICULTURAL DRAINAGE BASIN.
Uttar Pradesh Agricultural Univ., Naini Tal (India); and Illinois Univ, Urbana.
For primary bibliographic entry see Field 04A.
W70-07869

PRINCIPLES GOVERNING THE DESIGN AND CONSTRUCTION OF ECONOMIC REVETMENTS FOR PROTECTING THE BANKS OF RIVERS AND CANALS FOR OCEAN - AND INLAND NAVIGATION,
Ingenieur general des Ponts et Chaussees, Paris (France).
V. Le Gorgeu.
Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Sect 1, Subj 6, Inland Navigation, Paris, 1969, p 1-8.

Descriptors: *Retaining walls, *Construction costs, Bank stability, Canal design, Navigable waters, Grading, Dredging, Laterals, Construction materials, Canals.

General Report on Section 1, Subject 6, Inland Navigation, on the principles governing the design and construction of economic revetments for protecting the banks of rivers and canals for ocean and inland navigation. The Report includes summaries of articles written by Germany, Belgium, France, Italy, Japan, Netherlands, Poland, United Kingdom, U.S.A., and the Suez Canal (International Commission on Irrigation and Drainage). Abstracts of these articles are forwarded separately. Two copies of the General Report are given, one written in French and one written in English. (Grossman-Rutgers)
W70-07946

6B. Evaluation Process

SOCIAL AND ECONOMIC IMPACT OF SNOW SURVEY DATA,
Soil Conservation Service, Boise, Idaho.
Morlan W. Nelson.
Proceedings 37th Annual Meeting of Western Snow Conference, April 15-17, 1969, Salt Lake City, Utah; printed by Colorado State University, Fort Collins, p 83-87, 1969. 5 p, 2 fig, 5 ref.

Descriptors: *Snow surveys, *Social aspects, *Economics, *Cost-benefit analysis, Flood control, Water pollution control, Recreation, Reservoir operation, Water management (Applied), Planning, Economic impact, Social impact.
Identifiers: Snow survey data.

In general, there is a social and economic impact on many businesses or activities in the western United States from basic snow survey and water supply forecast data. However, in all cases, these data exert their influence through more efficient management of our basic resources of water and soil. Future generations will be more dependent upon the snow survey data than we are today, and upon the improvements that will be made through telemetry and new electronic equipment. A conservative estimate of the economic value of water supply forecasts to agriculture alone, excluding all Bureau of Reclamation projects, is responsible for a new increase in farm income of somewhere between $32,000,000 and $65,000,000 per year. The total economic and social impact is far greater than the primary farm income benefit. (Knapp-USGS)
W70-07676

CONFLICTS IN WATER USE AND REGIONAL PLANNING IMPLICATIONS,
Washington Univ., Seattle.
Ronald R. Boyce.
Edited by M. E. Marts, Regional Development and the Wabash Basin, p 145-156, University of Illinois Press, Urbana, 1964.

Descriptors: *Water utilization, Regions, Water resources development, Economics, Pacific Northwest U S.
Identifiers: *Conflicts, Shortages.

Water resource developments, comprising elements of private and public fiscal, economic, social, and political policy, are a fertile field for the generation of conflicts. This discussion provides examples of conflict situations and indicates some implications for planning. The discussion is focused on the Pacific Northwest where large and varied water resources support activities of vital importance in a limited regional economy: irrigation, hydropower production, fisheries, inland navigation, and recreation. Conflicts arise not so much because of shortages, but because of competing proposals for the use of important resources, or because of development proposals being opposed by those who see advantages in maintaining the status quo. (Loeb-Rutgers)
W70-07737

THE ECONOMICS OF PRODUCTION FROM NATURAL RESOURCES: NOTE,
Montana State Univ., Bozeman.
Ronald G. Cummings, and Oscar R. Burt.
American Economic Review, Vol 59, No 5, p 985-990, December 1969. 9 ref, 1 append.

Descriptors: *Natural resources, Economics, Resources, Investment, Capital, Mining, Profit.
Identifiers: *Production, Exhaustible resources, Replenishable resources.

The authors discuss a recent article by Vernon Smith which attempts to provide '...a unified theory of production from natural resources' encompassing production from exhaustible, as well as replenishable, resources. The authors question the general applicability of Smith's model with

reference to the optimum rate of production from exhaustible resources, and therefore his description of the optimum rate of investment in these industries. The purpose of this paper is first to discuss the limited nature of Smith's results concerning production and investment within the context of exhaustible resources, and secondly to present a model that retains Smith's emphasis on the interrelationship of capital and resource extraction, but conforms to the established theory concerning the economics of exhaustible resources. The model presented focuses on the individual firm and may prove to be applicable to the water resource area. (Loeb-Rutgers)
W70-07744

A COMPARISON OF BARTEN'S ESTIMATED DEMAND ELASTICITIES--WITH THOSE OBTAINED USING FRISCH'S METHOD,
California Univ., Los Angeles.
Robert Ayanian.
Econometrica, Vol 37, No 1, p 79-94, Jan 1969. 4 fig, 4 tab.

Descriptors: *Elasticity of demand, Demand, Marginal utility, Prices, Estimating, Statistical methods, Regression analysis.
Identifiers: *Frisch's method, Income elasticity, Direct elasticity, Cross elasticity, Want-independent goods.

From the knowledge of budget proportions, income elasticities, and income elasticity of the marginal utility of income, point estimates of all direct and cross demand elasticities with respect to price may be easily computed for want-independent goods. Estimates obtained in this manner are without standard errors. One method of ascertaining the reliability of such estimates is to compare them, under varying conditions, with corresponding estimates whose standard errors are known. Ragner Frisch has presented a method for computing all direct and cross demand elasticities under conditions of want-independence. Barten, using data for the Netherlands and the United Kingdom and assuming almost additive preferences, has obtained a complete set of direct and cross demand elasticities for a fourteen sector model. This paper gives the results of the application of Frisch's procedure to Barten's data to obtain a complete set of demand elasticities which are then compared to those presented by Barten. The author concludes that Frisch's method for the determination of all direct and cross demand elasticities should be of great value in those areas where little price data is available. This method, although complex, would be applicable in estimating water demand functions.
W70-07750

COMPETITION AND THE REGULATORY PROCESS,
James W. Karber.
The Quarterly Review of Economics and Business, Vol 9, No 3, p 57-64, Autumn 1969. 8 p.

Descriptors: *Public utilities, *Regulation, *Competition, Investment, Technology, Gross National Product, Economics, Costs, Prices, Transportation, Interest rate, Financing, Profits, Productivity, Efficiencies.
Identifiers: *Rate of return, *Promotion, Diversification.

In most regulated industries the issues of competition and promotional practices are being raised with increasing frequency. There are efforts to make greater competition a supplement to regulation. It is often pointed out that competition brings increased productivity and better resource allocation. The article shows, however, that the results of regulation in the U.S. have been good. Public utilities, which would include water utilities, are in the midst of a period of great technological change which presents problems for regulators. It is necessary that competitive forces be properly directed if they are to be useful. Competition and regulation are terms having little meaning in the abstract and must be applied to real regulatory situations if their values are to be tested. The approach to be used should be guided by society's individual and social goals. The importance of the regulatory process in many water resource projects make this a valuable article for the water resource planner. (Murphy-Rutgers)
W70-07753

DESIGN AND OPERATION OF LARGE DESALTING PLANTS,
For primary bibliographic entry see Field 03A.
W70-07854

ON OPTIMIZATION METHODS FOR BRANCHING MULTISTAGE WATER RESOURCE SYSTEMS,
Montana State Univ., Bozeman.
For primary bibliographic entry see Field 06A.
W70-07859

NOTE ON EVALUATIONS OF R/S FOR FRACTIONAL NOISES AND GEOPHYSICAL RECORDS,
IBM Watson Research Center, Yorktown Heights, N.Y.
Murad Taqqu.
Water Resources Research, Vol 6, No 1, p 349-350, Feb 1970. 2 p, 2 fig, 4 ref.

Descriptors: *Computer programs, *Statistics, Hydrologic aspects, Mathematical models.
Identifiers: Mistake, Fractional noises, Geophysical records.

A mistake in the computer program evaluating the statistic R/S affecting the figures in the papers of Mandelbrot and Wallis (Water Resources Research Vol 5, No 1:228-267, 1969; Vol 5, No 2:321-340, 1969; Vol 5, No. 4:917-920, 1969; Vol 5, No. 5:967-968, 1969) was found. Once the mistake was corrected, the self-similar model of hydrologic time series turned out better than what was thought from the above mentioned papers. The mistake had an important effect only when the lag s was small. Corrected graphs were shown of R/S for a sample of fractional Gaussian noise and a hydrologic record of annual tree ring indices for a bristlecone pine from White Mountain, California. The mistake was due to a discrepancy between the mathematical definitions of the sequential range R and the actual formula used in the program to compute this R. In copies of the R/S program distributed by SHARE the above mentioned error has been corrected. (Kriss-Cornell)
W70-07868

PROBABILISTIC SELECTION OF PROJECT DESIGN FLOODS,
Tennessee Valley Authority, Knoxville.
Bevan W. Brown, Jr.
Paper, American Society of Civil Engineers, National Water Resources Engineering Meeting, Memphis, Tenn, Jan 1970. 26 p, 6 fig, 4 tab.

Descriptors: *Probability, *Design flood, *Decision making, Spillway design flood, Design criteria, Dams, Flood forecasting, Maximum probable flood, Spillways, Hydrology, Floods, Flood damage, Risks, Statistical methods, Statistical models, *Mathematical models, Costs, *Numerical analysis, Equations, Economic justification, Design storm.
Identifiers: Spillway capacity, Design assumptions, Flood probability, Flood hydrology, Flood estimate, Selection.

Using a damsite on the lower Hiwassee River in the Tennessee River Valley as an example, the application of probabilistic techniques and decision theory in selection of project design floods is illustrated. Selection of the design flood for a structure can be divided into 2 steps: (1) forecasting probability of occurrence and magnitude of potential floods by applying probability theory, hydrometeorolog and hydrology; and (2) selecting a particular o timum design flood within the potential range applying statistical decision theory. Current pra tice in selecting design floods does not utilize fu statistical decision theory and is essentially arbitr ry. Bayesian statistical decision theory provides mathematical model for making engineering de sions in the face of uncertainty. The model can used to find the optimum decision and to evalua the price or cost of reducing the degree of risk some lower level. Information from probabilisti economic models should not be used as the so basis for selecting design floods, but such mode do provide the framework for improving curre procedures. (USBR)
W70-07887

WATER AND EFFLUENTS,
Society of Dyers and Colourists, London (E gland).
For primary bibliographic entry see Field 05D.
W70-07959

ECONOMIC RESPONSIBILITY FOR THE BY PRODUCTS OF PRODUCTION,
Resources for the Future, Inc., Washington, D.C.
Allen V. Kneese.
Annals of the American Academy of Political an Social Science, Vol. 389, May 1970, p 56-62. 1 fi 1 table, 3 ref.

Descriptors: *Economics, *Resource allocatio *Resources, Resource development, Institutions.
Identifiers: Environmental quality, System of in centives, Common property resources, Economi system.

The central concepts governing resources-alloca tion in the United States have historically bee private property, freedom of exchange and com petition. The social engine built on these concept has produced rapid exploitation of resources an rapidly rising per capita income in the Unite States. In recent years, however, resources whic cannot readily be reduced to private ownershi have become rapidly more important, and they ar being overused and misused. The pollution of such 'common property' resources as water and the ai mantle is inherent in an economic system such a ours, once a certain stage of economic develop ment is reached. To deal successfully and effi ciently with these problems will require designin new governmental institutions, and especially, al tering our system of incentives in such a way tha the value of common property resources i reflected in market-type decisions. (Davis Chicago)
W70-07985

OUTDOOR RECREATION ECONOMICS,
Resources for the Future, Inc., Washington, D.C. and George Washington Univ., Washington, D.C.
John V. Krutilla, and Jack L. Knetsch.
Annals of the American Academy of Political and Social Science, Vol. 389, May 1970, p 63-70. 3 ref.

Descriptors: *Recreation, *Economics, Resource allocation, Economic efficiency, Distribution, Resource mix.
Identifiers: *Ourdoor recreation.

Outdoor recreation economics is an area similar to numerous other study areas in the general field of economics. Economists working in this area are concerned with the efficiency of the allocation of resources between outdoor recreation facilities and programs, on the one hand, and goods and services, generally, on the other--and, within the area of outdoor recreation, with the efficiency of the resultant mix of facilities and programs. Concomitantly, they become involved with the question of 'distributive justice', namely, the distribution of recreational opportunities among the various segments of the population. In this paper, we distinguish roughly between resource-oriented outdoor recreation and

ulation- or market-oriented outdoor recreation. he former, we find a predominantly middle-or er-middle-income clientele and an economic ironment which favors application of the lytical, management, and policy tools of 'effi- ncy economics'. In the latter, we find concentra- ns of the impoverished among ghetto residents, the question of equitable distribution of recrea- al facilities and programs becomes equally as ortant as the efficiency with which they are pro- d. (Davis-Chicago)
0-07986

SOURCES AND SOCIAL STRUCTURE: ME CONDITIONS OF STABILITY AND ANGE,
e Univ., New Haven, Conn.
liam R. Burch.
nals of the American Academy of Political and ial Science, Vol. 389, May 1970, p 27-34. 2 ta- s, 15 ref.

criptors: *Resources, *Social change, source development, Resource allocation, ural resources, Attitudes, Social values.
ntifiers: *Social structure, Society.

nan societies exist within certain resource ts. Those limits reflect particular combinations materials, language, and social structure and ermine tendencies toward social stability or nge. Such issues seem best approached taphorically. Energy stands for the level of ource-development a particular society has ched. Permeability indicates how distribution is nged by the social structure; and myths stand the group's available perception and its trajec- of belief. Such metaphorical coordinates may mit prediction as to the future of a society. For mple, the emergence of Western industrialism dependent upon the surplus energy of a fronti- with the closing of that frontier, the associated al structures and mythologies now seem ill- pted to the new environmental limits. (Davis- cago)
0-07987

INKING SOCIAL-SCIENTIFICALLY ABOUT VIRONMENTAL QUALITY,
nsylvania Univ., Philadelphia, Pa.
nuel Z. Klausner.
nals of the American Academy of Political and ial Science, Vol. 389, May 1970, p 1-10.

criptors: *Environment, *Social aspects, hnology, Management, Social Values, Social ds.
ntifiers: *Environmental quality, Environmental blems.

hnological intervention to improve the quality he environment is an immediate need. The cur- environmental crisis is rooted in the character he society which develops and uses technology. relation of society to its physical environment governed by the society's definitions of its urces and the rules evolved for regulating so- relations with respect to the environment. Fun- ental solutions to environmental problems t, therefore, include social solutions. To stem erioration of the quality of the environment will uire an examination of those rules regulating the tion between individuals and the collective. vis-Chicago)
0-07988

E TECHNOLOGICAL IMPERATIVE--SO- L IMPLICATIONS OF PROFESSIONAL CHNOLOGY,
Kinsey and Co., Inc., Washington, D.C.
id B. Hertz.
nals of the American Academy of Political and ial Science, Vol 389, May 1970. p 95-106, 35

criptors: *Technology, *Social aspects, *En- nment, Management, Social values.
Identifiers: *Technological imperative, Environmental problems, Professional technology.

Engineers and technologists have always considered themselves to be protagonists and leaders in man's struggle against nature. Each successful engineering project has been conceived as one more victory in the campaign to master the natural environment. By virtue of their successes, feeling has grown that there were no results that could not be achieved. But should man consider nature his enemy. If so, how can he win. Each time that technology has changed nature, there have been negative effects which had not been foreseen. These negative spillovers have rapidly multiplied the total environmental problem of the planet. It has now become clear that increasing population and changes in the rate of energy consumption are pushing toward a destructive total thermodynamic balance. If this change is not to be catastrophic, man will have to find a way to achieve an energy equilibrium. The technologist and engineer must be at the forefront of this search. For some reasonable expectation of success, a new approach will have to become part of technological problem-solving. This approach must involve technological assessments and evaluations that include much broader constraints than have been imposed in the past. The technological imperative calls for the reconstruction of engineering and technological curricula to include truly effective evaluation and assessment of proposed solutions to technological problems. (Davis-Chicago)
W70-07991

THE SOCIAL AND PERSONALITY CORRELATES OF OUTDOOR RECREATION,
Virginia Univ., Charlottesville.
Abbott L. Ferriss.
Annals of the American Academy of Political and Social Science, Vol 389, May 1970. p 46-55, 4 tables, 20 ref.

Descriptors: *Recreation, *Social aspects, *Psychological effects, Social values, Attitudes, Social needs.
Identifiers: Sociocultural system.

The sociocultural system, through rewards such as status, sociability of group activities, value orientations, attitudes, and the like, evokes outdoor recreation preferences, as is revealed by actual participation rates. Physical activity associated with many forms of outdoor recreation leads to more vigorous health. Physical activity groups, such as athletes engaged in a particular sport, exhibit personality traits that are different from those of nonathletes. However, it has not been demonstrated that personality traits are altered through participating in physical exercise or sport. Persons with different socioeconomic characteristics exhibit different recreation participation rates. From 1960 to 1965, these rates have been changing. Major increases in passive recreational activities have occurred, but participation rates in activities that require large allocations of natural resources have increased very little active forms of recreation, chiefly characterizing youth, have increased notably, while backwoods activities have increased only slightly. (Davis-Chicago)
W70-07992

ANTICIPATIONS OF CHANGE: A SOCIO-ECONOMIC DESCRIPTION OF A KENTUCKY COUNTY BEFORE RESERVOIR CONSTRUCTION,
Kentucky Water Resources Inst., Lexington.
Charles Robert Smith.
Available from the Clearinghouse as PB-192 636, $3.00 in paper copy, $0.65 in microfiche. Research Report No. 28, 1970. 161 p, 7 tab, 53 ref. OWRR Project A-022-KY (8).

Descriptors: *Planning, *Attitudes, Human population, *Social impact, *Social change, Social values, Kentucky, Reservoirs, Social adjustment.

In the past the construction of large reservoirs in the United States has been evaluated largely in terms of the economic benefit they bring to the area where they are constructed and to the nation. Where human populations are involved, however, a host of social changes occur, many of which fundamentally alter the way of life of a people. The report is part of a larger study which aims at analyzing the social costs and benefits of reservoir construction. This document concentrates on the social and economic description of a rural county before reservoir construction by the United States Corps of Engineers. The major findings in this study point to the preconstruction impact that the reservoir has on people.
W70-07994

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE FIRM'S LONG-RUN AVERAGE COST CURVE,
National Chengchi Univ., Taipei (Taiwan).
Chen Fu Chang.
Quarterly Review of Economics and Business, Vol 9, No 4, p 80-84, Winter 1969. 5 p.

Descriptors: *Costs, *Economics, Economic efficiency, Optimization, Return to scale, Profits, Costs analysis, Technology, Average costs.
Identifiers: *Long-run costs, *Short-run costs, *Least cost point, Plant size, Cost curves.

The normal case of the firm's long-run average cost (LAC) curve has been known as an 'envelope' curve which is tangent to a series of the U-shaped short-run average cost (SAC) curves and which itself takes a flatter U-shape. The author finds fault with the usually assumed shape of the SAC curves which dictates that output at less than the least-cost point of the LAC curve be best produced with a larger plant operating at less than its optimum whereas the output at more than the least-cost point of the LAC curve be best produced with a smaller plant operating at more than its optimum. The author shows that with few exceptions there seems to be no reason for the least-cost of the SAC curves to be standing off the LAC curve, and the normal case of the LAC curve should consist of a series of the least-cost points of U shaped SAC curves. The theoretical implications of this article for scale of plant in water industries should make it of interest to the water researcher. (Murphy-Rutgers)
W70-07754

USE OF TAXES, SUBSIDIES, AND REGULATIONS FOR POLLUTION ABATEMENT,
Clemson Univ., S.C. Water Resources Research Inst.
For primary bibliographic entry see Field 05G.
W70-07802

6D. Water Demand

PRELIMINARY COMMUNITY AND REGIONAL WATER SUPPLY DATA IN SUPPORT OF DESALTING PLANT PROJECTIONS,
Black and Veatch, Kansas City, Mo.
For primary bibliographic entry see Field 03A.
W70-07650

WATER RESOURCES OF NEW MEXICO: OCCURRENCE, DEVELOPMENT, AND USE,
New Mexico State Engineer Office, and New Mexico Interstate Stream Commission.

Santa Fe, State Planning Office, 1967. 321 p, 46 fig, 4 pl, 63 tab, 229 ref.

Descriptors: *Water resources development, *Water supply, *Planning, *New Mexico, *Hydrology, Colorado River basin, Rio Grande,

Arid lands, Geology, Semiarid climates, River basins, River basin development, Surface waters, Groundwater, Groundwater basins, Water utilization, Water resources, Natural resources, Consumptive use.
Identifiers: Arkansas River basin, Pecos River basin, San Juan River basin.

This report on the water resources of New Mexico was prepared as a contribution to the New Mexico Resources Development Plan. An introductory summary outlines statewide water conditions. Otherwise, the data presented in the report are grouped according to the nine major surface-water drainage areas of the state. These drainages are: Arkansas River basin, Southern High Plains, Pecos River basin, Central closed basins, Rio Grande basin, Western closed basins, San Juan River basin, Lower Colorado River basin, and Southwestern closed basins. Each basin report is divided into two major sections: one part deals with geography, geology, and hydrology; the other concerns the history of settlement, development, and water use. The report is amply supplied with explanatory figures and tables. (Carr - Arizona)
W70-07786

OPTIMUM OPERATION OF DESALTING PLANTS AS A SUPPLEMENTAL SOURCE OF SAFE YIELD,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 03A.
W70-07865

6E. Water Law and Institutions

BEMIS V BEMIS (OWNERSHIP OF LAKE BEDS).

11 A2d 218-219 (Vt 1940).

Descriptors: *Vermont, *Riparian rights, *Ownership of beds, *Boundaries (Property), Non-navigable waters, Ponds, Lakes, Land tenure, Legal aspects, Lake shores, Banks, Watercourses (Legal), Boundary disputes, Lake beds, Riparian land, Riparian waters, Judicial decisions, Relative rights.
Identifiers: *Public water.

Plaintiff sued for trespass upon a lake. Defendant had title to most of the land surrounding the lake and claimed ownership of the land under it. A small parcel of defendant's land was previously owned by a third party who gave plaintiff a quit-claim deed to the lake and the land under it. Plaintiff claimed title to the center of the lake under the rule that when conveyed land is bounded by a non-navigable stream or pond, the grantee takes to the center if his grantor owned that far. Defendant claimed that plaintiff's grantor's land ran only to the banks of the lake, and was not bounded by the lake. The court held that it is a fact question whether the grantor's land bounded on the lake. Where the description of the property conveyed runs the boundry along dry land such as a bank, shore or margin of a private pond or lake, land under water is excluded from the conveyance. In the instant case, the court found that plaintiff's grantor's land ran only to the bank of the lake. Consequently, since plaintiff's grantor had no title to the bed of the lake, plaintiff acquired none. (Leesfield-Florida)
W70-07858

LOWE V GREEN MOUNTAIN POWER CORP (DISPUTE BETWEEN ADJACENT RIPARIAN OWNERS AS TO WATER RIGHTS IN POND).

11 A2d 219-222 (Vt 1940).

Descriptors: *Vermont, *Boundary disputes, *Prescriptive rights, *Boundaries (Property), Judicial decisions, Legal aspects, Relative rights, Lakes, Ponds, Land tenure, Lake shores, Boating, Dams, Bulkheads, Bulkhead gates, Mills, Saw mills, Fishing, Water rights, Access routes, Hydroelectric plants, Real property.

Both plaintiff and defendant, owners of adjacent lots on a pond, claimed water rights to three-fifths of a dam and bulkhead on the pond, and to a part of the pond itself. Plaintiff sought to enjoin the occupation and use of such rights by the defenant power corporation. Both claimed the pond rights by virtue of the boundaries set forth in their chains of title, and plaintiff also argued that the boundary line had been established by acquiescence. Plaintiff and her predecessors had used the disputed portion of the pond for boating and fishing, for the washing of clothes, and for the operation of a saw mill. In deciding for the defendant, the appellate court held that the property conveyance upon which plaintiff relied was insufficient to establish her claim to the water rights. Moreover, the facts upon which plaintiff relied to show acquiescence were not so compelling as to require a reversal of the decision by the chancellor in the lower court. (Marsee-Florida)
W70-07862

WALDEN V PINES LAKE LAND (RIGHT OF USE BY CREATORS OF ARTIFICIAL LAKE).
126 N J Esq 249, 8 A2d 581-584 (1939).

Descriptors: *New Jersey, *Easements, *Usufructuary right, *Artificial watercourses, Lake beds, Ownership of beds, Land tenure, Contracts, Claims (Contracts), Benefits, Costs, Judicial decisions, Watercourses (Legal), Buoys, Roads, Boating, Remedies, Legal aspects, Overflow, Dams, Fishing, Water utilization, Damages, Streams.

Plaintiff and defendant owned adjoining tracts of land across which flowed a brook. Pursuant to a contract between them, plaintiff and defendant dammed the brook and created a lake upon both tracts. Defendant then proceeded to establish a dividing line of buoys across the lake, prohibiting the use of the lake as an entity. Plaintiff brought action to reform the contract, to restrain interference with his rights of use in the lake, to restrain maintenance of the buoys, and to recover damages. The court held that plaintiff, without the showing of an easement, had no right to use those portions of the lake above defendant's land. However, pursuant to the terms of their contract, each party had obtained such an easement to use the waters above the other's land. Defendants were estopped to deny plaintiff use of the entire lake. A landowner who permits flowage over part of his land to form a lake, and who pays a portion of the costs for such, obtains an easement or license to use the entire lake. (Marsee-Florida)
W70-07866

SMELCER V RIPPETOE (PRESCRIPTIVE RIGHT TO FLOOD LAND).
147 SW2d 109-115 (Tenn Ct App 1940).

Descriptors: *Tennessee, *Easements, *Prescriptive rights, *Dams, Legal aspects, Boundaries (Property), Proprietary power, Relative rights, Flooding, Repulsion (Legal aspects), Riparian land, Riparian rights, Usufructuary right, Watercourses (Legal), Concrete dams, Mill dams, Backwater, Damsites, Overflow, Floodwater, Water injury.
Identifiers: *Injunction (Prohibitory).

Defendant purchased a dam and adjoining land. The dam had existed in one form or another for over 100 years, during which time the stream that it impounded had continuously flooded plaintiffs' lowlands at high tides. Six years prior to defendant's acquisition of the dam, a presumably criminal dynamite explosion partially destroyed it. The release of impounded waters caused by such partial destruction eliminated the flooding of plaintiffs' land. Defendant's predecessor in title had been financially unable to repair the dam after the explosion; consequently, it had remained out of use until defendant acquired title. Plaintiffs sued to enjoin defendant's repair of the dam, contending that previous owners had not legally owned the dam and, in any event, defendant's immediate predecessor in title had abandoned it in that it had been out of use for 6 years. The court held that the open and continued existence and maintenance of the dam for more than the prescriptive period of 20 years created a prescriptive right in the dam owner to cause flooding of plaintiffs' lands. Such right attached to the dam in serviceable condition, not merely to the damaged remains. Moreover, the financial inability of defendant's vendor to repair the dam indicated no intent to abandon it. (Clark-Florida)
W70-07867

MCDONALD V SARGENT (DESTRUCTION O PRESCRIPTIVE EASEMENT BY NONUSER).

13 NW2d 843-844 (Mich 1944).

Descriptors: *Michigan, *Easements, *Prescriptiv rights, *Flood damage, Land tenure, Legal aspect Dams, Land use, Overflow, Grants, Floodin Streams, Judicial decisions, Pastures, Competir uses, Wetlands, Relative rights.
Identifiers: *Injunction (Prohibitory).

A creek crossed plaintiffs' farm and ran below defendants' land where a dam, owned by defe dants, was located. Between 1901 and 1905 th dam was washed away, and it was not rebuilt un 1930. Plaintiffs claimed that the rebuilt dam r tarded the flowage of water and caused saturatio of their low land, and sought to enjoin suc floodage. Defendants answered that the rebui dam caused no greater floodage than the origin dam and that by old grants and prescriptive righ plaintiffs could not recover. Plaintiffs denied th claimed grants and averred that the prescriptiv rights were lost by defendants' nonuser for 25 yea after the old dam was destroyed and before the ne dam was erected. The court, in granting plaintiff injunction, held that nonuse of the dam by defe dants for a period of 25 years resulted in a loss the original easement. The court drew a distinctio between easements acquired by grant, which cou not be extinguished by nonuser, and easemen acquired by prescription. A prescriptive easeme is an unopposed continuous trespass for 15 yea which can be lost by nonuser for a period equal that required for its creation. (Leesfield-Florida)
W70-07910

WEATHER MODIFICATION IN POPULATE AREAS,
EG and G, Inc., Bedford, Mass.
For primary bibliographic entry see Field 03B.
W70-07984

GREAT LAKES INSTITUTIONS, A SURVEY O INSTITUTIONS CONCERNED WITH TH WATER AND RELATED RESOURCES IN TH GREAT LAKES BASIN.
Committee on Multiple Use of the Coastal Zon Washington, D.C.

Great Lakes Basin Commission, June 1969. 58 p, append.

Descriptors: *Great Lakes, *Great Lakes Regio *Institutions, Federal government, Communic tion, Planning, Methodology, Coordination, I stitutional constraints, Organizations, Gover ments, Administration.

The purpose of this document is to prepare a co temporary survey of institutions having respon bility for or interest in the Great Lakes which c be used as a tool by these institutions to aid reducing confusion and improving communicatio and coordination. This institutional confusion due to the dramatic increase in recent years of i stitutions concerned with the Great Lakes. Mi sions sometimes are uncoordinated and ove lapping and cohesiveness and unity of purpo among these institutions require strengthenin

sumes of the various institutions concerned with
Great Lakes are presented in five major
oupings: international (United States and
nada) institutions, Canadian institutions, federal
nited States) institutions, states and universities,
d private institutions. (Davis-Chicago)
70-07989

**THORITY AND RESPONSIBILITY FOR EN-
RONMENTAL ADMINISTRATION,**
iana Univ., Bloomington.
nton K. Caldwell.
nals of the American Academy of Political and
cial Science, Vol 389, May 1970, p 107-115.

scriptors: *Administration, *Environment, In-
utions, Political aspects, Management, Legal
ects, Attitudes, Social values, Institutional con-
ints.
ntifiers: *Environmental administration, Policy,
n-environment relationships, Politico-ethical
ology, Public authority, Public responsibility.

thority and responsibility for ecologically sound
icies for man-environment relationships are
fused by the lag between the changing circum-
nces of man-on-earth and his assumptions,
avior patterns, and institutions. In the United
tes, many attitudes which were hitherto feasible
e now become harmful. Sanctification of politi-
forms and unrealistic appraisals of the ten-
cies of technological society severely handicap
sent efforts to cope with environmental
blems. If society is to deal effectively with these
blems, political and administrative leadership
be required to help the people to understand
necessity for certain changes in their expecta-
s, laws, and public institutions. A new, ecologi-
y valid politico-ethical ideology is needed to
timize the tasks of public authority and respon-
lity that an effective effort to cope with man's
ironmental problems would require. A dual cri-
of attitudinal and institutional inadequacy must
surmounted if the resulting crisis of the environ-
nt is to be overcome. (Davis-Chicago)
0-07990

**E ENVIRONMENTAL DISPOSITIONS OF
VIRONMENTAL DECISION-MAKERS,**
ifornia Univ., Berkeley.
primary bibliographic entry see Field 06G.
0-07993

**RRIS V TOWNSEND (SUIT TO ACQUIRE
E OF ARTIFICIAL LAKE BY NON-RIPARI-
OWNER).**

SE2d 819-824 (SC 1970).

scriptors: *South Carolina, *Easements,
kes, *Artificial watercourses, Developed
ers, Dams, Watercourses (Legal), Land tenure,
ative rights, Prescriptive rights, Water rights,
arian rights, Judicial decisions, Legal aspects,
oding, Surface waters, Recreation, Impound-
nts, Discharge (Water), Impounded waters,
inage systems, Riparian land, Remedies, Real
perty.

fendant constructed a dam on his property and
ated an artificial lake. Plaintiffs' predecessors in
granted an easement to defendant to flood a
tion of their land in creating the lake, reserving
a right to fill in that portion if they so desired.
fendant subsequently prohibited use of the lake
plaintiffs or by residents of plaintiffs' trailer park
ated on land adjacent to the lake. In this action
ntiffs sought authorization for use of the lake.
court, in holding for defendant, ruled that a
riparian owner seeking use of a lake must base
claim on a right acquired by prescription or
nt. The easement created only a dominant and a
vient estate and granted no right to use the lake.
sole, express reservation of the right to fill the
ndated portion tended to negate the existence of
er reserved or implied rights in plaintiffs. The court did grant a request by defendants for an injunction to prohibit plaintiffs from collecting surface water in an artificial drainage system and casting them in concentrated from upon the property or the lake of defendant. (Hubener-Florida)
W70-08005

SLAYTON GUN CLUB V TOWN OF SHETEK (LAKES AND STREAMS INCLUDED IN TERM LAND).
176 NW 2d 544-548 (Minn 1970).

Descriptors: *Minnesota, *Ownership of beds, *Access routes, *Land classification, Lake beds, Land tenure, Beds under water, Local governments, Legislation, Islands, Arable land, Non-navigable waters, Real property, Right-of-way, Administrative agencies, State governments, Adjudication procedure, Judicial decisions.

Plaintiff owned 45 acres of property which was inacessible except over lands owned by others. Pursuant to a state statute, plaintiff applied to the town board to establish a cartway between his land and a public road. The town board denied plaintiff's petition stating he did not own at least 5 acres of land as required by the statute. The court found that while plaintiff did own an area of 45 acres, less than 5 acres were above water. The court held for plaintiff, however, stating that the word 'land' in the statute included submerged land. The court stated that the word 'land', if unmodified by a restrictive word such as 'tillable', would include soil, lakes and streams. (Hubener-Florida)
W70-08006

CASTAWAYS MOTEL V SCHUYLER (STATE'S CONDITIONAL GRANT OF A RIVERBED).
25 NY2d 692, 306 NYS2d 692 (1969).

Descriptors: *New York, *Ownership of beds, *Public lands, *Administrative agencies, River beds, State governments, Navigable rivers, Flooding, Flood damage, Landfills, Navigable waters, Water rights, Water law, Management, State jurisdiction, Remedies, Legal aspects, Judicial decisions, Rivers, Land, Land tenure, Regulation, Damages, Real property.
Identifiers: *Grants (Land).

Plaintiff private landowner received from defendant Commissioner of General Services a grant of state lands beneath the Niagara River. The grant was conditional in that it contained a covenant to forego future damages. Prior to plaintiff's knowledge of the conditional nature of the grant, he expended a considerable sum in filling the land. Thereafter, plaintiff sought delivery of the lands without the condition attached to the grant. Defendant contended such condition was necessary in order to protect the state as intrusion of landfills in rivers would increase the possibility of flooding and damage in the course of public power development. The court held defendant, in having authorized a grant of state lands, could impose only reasonable conditions upon the recipient landowner, including a covenant to forego future damages. (Finman-Florida)
W70-08007

CZARNIK V SAMPSON ENTERPRISES, INC (LEASING OF PROPERTY ACQUIRED BY EMINENT DOMAIN).

175 NW2d 487-491 (Wis 1970).

Descriptors: *Wisconsin, *Condemnation, *Drainage systems, *Leases, Sewage districts, Local government, Easements, Right-of-way, Legal aspects, Land tenure, Drainage programs, Judicial decisions, Ditches, Water management (Applied), Eminent domain, Administration, Land use.

Defendant corporation acquired a lease to a certain piece of property from a county sewage district. The land originally had been condemned by the federal government in 1944 for a perpetual easemant and right-of-way for a drainage ditch, but these rights were acquired by the sewage district. Plaintiffs, whose predecessors in title owned the land in 1944, sought to enjoin use of the land by defendant, arguing that the lease increased the burden of the easement on their land. The court stated that an easement should be construed to leave the owner with the greatest possible estate since easement rights are acquired by compulsion. The estate acquired should be no greater than what is reasonably necessary to carry out the purpose of the condemnation proceeding. In holding for defendants and denying the injunction, the court ruled that the terms of the lease were consistent with the interest acquired by condemnation in 1944, and the granting of the lease did not constitute an abandonment of the rights and interests of the district in the property. (Hubener-Florida)
W70-08008

ARKANSAS LAND AND CATTLE CO V ANDERSON-TULLY CO (BOUNDARY DISPUTE CAUSED BY ACCRETION).
452 SW2d 632-641 (Ark 1970).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Avulsion, *Boundary disputes, Land tenure, Boundaries (Property), Bank erosion, Water law, Mississippi River, Islands, Navigable rivers, Real property, Channel erosion, Jurisdiction, Geomorphology, Sedimentation, Sand bars, Currents (Water), Thalweg.

Plaintiff Arkansas landowner brought suit to quiet title to land located in the Mississippi River between the states of Arkansas and Mississippi. Plaintiff claimed the land was separated from the Arkansas mainland by avulsion and consequently title to the land remained in it. Defendant Mississippi landowner claimed the tract as an accretion to its lands in Mississippi. The lower court decided that the tract had been formed by erosion and accretion to defendant's land and dismissed the suit for lack of jurisdiction. The Arkansas supreme court adopted the factual findings that the area in question had been within the boundaries of sections of land owned by plaintiff according to a federal survey of 1825 and that the land in dispute was not formed until 1862-1874. The supreme court also acknowledged that the sailing channel of the river at the time of the suit ran between the tract in question and the Arkansas shore. The supreme court reversed, however, and held that the presumption that land is formed in a river by accretion rather than avulsion operates only where there is no countervailing evidence. The burden was on defendant to prove that the land in question was formed by accretion. Since defendant had failed to meet the burden of proof of accretion, the Arkansas court retained jurisdiction over the land. (Hubener-Florida)
W70-08009

UNITED STATES V SEVERSON (OWNERSHIP OF ISLANDS IN NAVIGABLE WATERS).
309 F Supp 915-917 (W D Wisc 1970).

Descriptors: *Wisconsin, *Boundaries (Property), *Islands, *Boundary disputes, Deposition (Sediments), Beds under water, Federal jurisdiction, Patents, River flow, Channel morphology, Shores, Navigable waters, Ownership of beds, Judicial decisions, Legal aspects, Accretion (Legal aspects).

The United States brought action to clear title to islands located between shorelands owned by defendants and the thread of the Mississippi River. Defendants contended that ownership of the shorelands and the operation of Wisconsin law gave them title to all lands here involved. The court held that all islands in existence in navigable waters at the time a state is admitted to the Union remain under federal ownership until specifically conveyed away. These lands were not so conveyed, and Wisconsin, therefore, had no title to convey to defendants by operation of law or otherwise. (Price-Florida)

W70-08011

UNITED STATES V RAY (FEDERAL JURISDICTION OVER AND RIGHT TO SUBMERGED CORAL REEFS).
423 F2d 16-23 (5th Cir 1970).

Descriptors: *Federal jurisdiction, *Continental shelf, *Reefs, *Beds, Coastal structures, Florida, Caissons, Coasts, Coral, Construction, Federal government, Remedies, Legal aspects, Water rights, Exploitation, Exploration, Natural resources, Public benefits, Judicial decisions, International law, Legislation, Oceans, Regulation.
Identifiers: *Injunction (Permanent), *Outer Continental Shelf Lands Act.

Defendants were rival private claimants who desired to build an island nation upon two submerged coral reefs located four and one-half miles from the coastline of Southeastern Florida. The reefs were part of a seabed of the outer continental shelf. Defendants had actually begun construction of caissons on the reefs at the time the United States, as plaintiff, brought proceedings to permanently enjoin their activities. The Court of Appeals based their granting of the injunction upon several grounds. First, defendants' activities were unlawful without the issuance of a permit from the Secretary of the Army under authority of the Outer Continental Shelf Lands Act. Secondly, plaintiff had the sovereign and exclusive right to the jurisdiction and control of these reefs for purposes of exploitation and exploration. Specifically, these reefs were within the area designated as the continental shelf by both the Outer Continental Shelf Lands Act and the Geneva Convention on the Continental Shelf. The Geneva Convention confirmed the exclusiveness of plaintiff's rights, particularly with reference to the natural resources of the continental shelf. Finally, plaintiff had a vital interest in preserving these reefs for public use and enjoyment. (Finman-Florida)
W70-08012

CHOCTAW NATION V OKLAHOMA (OWNERSHIP OF RIVER BEDS).

90 S Ct 1328-1346 (1970).

Descriptors: *United States, *Oklahoma, *River beds, *Ownership of beds, Submerged lands, Riparian rights, Federal government, Navigable rivers, Relative rights, Remedies, Legal aspects, Judicial decisions, Treaties, Water law, Leases, Patents, Royalties, Indian reservations, Federal reservations, State governments, Federal jurisdiction.

Plaintiff Indian nations brought action against defendant state to recover royalties which stemmed from mineral leases to land underlying navigable portions of the Arkansas River which ran through their reservations. Defendant claimed title to the land in question had passed to it through the granting of statehood, while plaintiffs alleged title had previously passed to them through treaties and patents. The major question involved whether the vast tracts of land granted the Indians included the beds of the navigable portions of the river which ran through the tracts. If this were to be answered in the negative, then the title would have been reserved in the United States and would have passed to Oklahoma at statehood. The United States Supreme Court reasoned that since the beds were not specifically excluded in the grants to the Indians and since questions regarding treaties with Indian nations are to be resolved in favor of the Indians, the title to the beds had passed in fee simple to plaintiffs. (Barker-Florida)
W70-08014

HARDIN V JACKSON YACHT CLUB, INC (LIABILITY FOR BOAT COLLISION WITH UNLIGHTED CONCRETE WALL).
232 So 2d 721-729 (Miss 1970).

Descriptors: *Mississippi, *Accidents, *Reservoirs, *Retaining walls, Riprap, Barriers, Concrete construction, Boats, Concrete structures, Dams, Bank protection, Bank stabilization, Erosion control, Shore protection, Navigation, Warning systems, Lakes, Safety, Safety factors, Remedies, Hazards, Legal aspects, Judicial decisions.
Identifiers: *Negligence.

Plaintiff brought action against the owner of a motorboat and a yacht club to recover for the wrongful death of an occupant of the motorboat during a boating excursion upon a reservoir. The plaintiff alleged that the defendant boatowner had been negligent in operating the boat and that the defendant yacht club had been negligent in constructing the unlighted concrete retaining wall which extended out into the lake and which the boat struck at night. The lower court found the boat operator negligent but exonerated the yacht club of negligence. Plaintiff appealed contending he was entitled to a directed verdict against the yacht club. The appellate court held that the lower court had established three determinative questions: (1) whether the club was negligent in constructing the unlighted wall; (2) whether such negligence, if found, was a proximate cause of the accident; and (3) whether the boat struck the wall or a rocky section of the shoreline known as a riprap. The court held these were questions for the jury and affirmed the verdict for defendant. (Hubener-Florida)
W70-08015

PADDOCK V TOWN OF DURHAM (DAMAGES FROM TEMPORARY EASEMENT FOR SEWER CONSTRUCTION).

261 A2d 438-442 (N H 1970).

Descriptors: *New Hampshire, *Easements, *Eminent domain, *Sewers, Structures, Cities, Manholes, Sewage disposal, Damages, Costs, Condemnation, Legal aspects, Leaching, Artesian wells, Septic tanks, Domestic wastes, Judicial decisions, Riparian land, Remedies.
Identifiers: Temporary easements.

Plaintiff riparian landowner brought suit for damages to his property incurred when defendant municipality constructed a sewer line on it. Both a temporary easement for the purpose of construction and a permanent easement for continued operation had been taken by means of defendant's power of eminent domain. Plaintiff alleged that the easement prevented the construction of a boathouse on the shore of his porperty. Following a judgment for plaintiff, defendant appealed on grounds of improper methods of assessments of damages through the use of illegal evidence and instructions. The Supreme Court of New Hampshire held that the measure of damages for a temporary easement differs from standards applied in a permanent taking. The court stated that the measure was that of the value of the use deprived of during the temporary easement and the cost necessary to restore the property to its original value. The judgment in favor of the plaintiff was affirmed. (Barker-Florida)
W70-08016

PARR V CITY OF ERLANGER (ASSESSMENTS FOR MUNICIPAL IMPROVEMENT BENEFITS).

438 SW2d 785-788 (Ky 1969).

Descriptors: *Kentucky, *Tangible benefits, *Cities, *Assessments, Judicial decisions, Water supply, Construction, Rates, Legal aspects, Sewers, Pipes, Taxes, Value, Evaluation, Eminent domain, Condemnation, Roads, Right-of-way, Plumbing, Water costs, Water rates, Project planning, Public health, Water transfer, Direct benefits.

Plaintiff municipality sought to collect assessments against defendant's property for street, water and sewer improvements. Defendant resisted payment alleging that the municipality knew the property sought to be assessed was included in a planned right-of-way for an interstate highway and thus was in no way benefited by the improvements. The court held that actual benefit to the property by the improvements was inconsequential to defendant because upon sale of the condemned land, the amount received in payment was the value of the land as appreciated by the water, street and sewer improvements. The property was benefited in this manner and thus subject to assessment based on the amount of front-footage improved property. The court held further that each foot of property benefited must be proportionately assessed, not solely that portion of the property to which the improvements extended. (Barnett-Florida)
W70-08017

MARIBU V NOHOWEC (MUNICIPALITIES ADHERENCE TO STATE WATER SUPPLY STATUTES).
161 Misc 944, 293 NYS 457-464 (Sp Ct 1937).

Descriptors: *Contract administration, *New York, *Water supply, *Municipal water, Water consumption, Water works, Water control, Utilities, Bids, Contracts, Costs, Local governments, State governments, Legislation, State jurisdiction, Legal aspects, Administrative agencies, Judicial decisions, Cities.

Defendants, the mayor and trustees of a village, authorized a contract for the construction of a well and pumping equipment for the village. Plaintiff, a taxpayer brought this action to have the contract award declared null and void. Plaintiff contended that defendant had acted in violation of state law by failing to publicly solicit bids for the contract. In holding for plaintiff the court stated that a municipality has full power to establish or extend a waterworks system. However, the question of water supply is one of state-wide concern over which the legislature has full control. As representatives of a political subdivision of the state, defendants were required to adhere to a state statute requiring public solicitation of bids. Although the court found no fraud, bad faith or waste of the taxpayers money, it did find a violation of the law and declared the contract null and void. (Hubener-Florida)
W70-08028

SHARP V LEARNED (CHANGE OF RIVER CHANNEL BY ACCRETION OR AVULSION).
14 So 2d 218-222 (Miss 1943).

Descriptors: *Mississippi, *Accretion (Legal aspects), *Avulsion, *Boundary disputes, Judicial decisions, Mississippi River, Rivers, River flow, Alluvium, Boundaries (Property), Meanders, Bank erosion, Erosion, Sediments, Stream erosion, Channels, Real property, State governments, Louisiana, Legal aspects, Relative rights.

Becuase of the continuous change of the main channel of the Mississippi River, a dispute arose over whether certain lands lay within Mississippi or Louisiana. The court held that a transfer of territory by erosion on one side of a boundary river and accretion on the other becomes a part of the state to which it is added, whereas territory transferred by avulsion continues to be a part of the original state. Accretion or alluvion was defined as that added imperceptibly and gradually, and avulsion as a change measurably visible at the time of its progress. The distinguishing test was found to be with relation to the alluvion formed by accretion which normally runs parallel to the shore. Any remarkable departure from that rule within a short period of time was held to be an inference that there had been an avulsion. Under those rules the land in question was found to be formed as the result of avulsion and not by gradual erosion and accretion. (Douberley-Florida)
W70-08029

AVANAUGH V TEXAS DISTRIBUTING CO RTIFICIAL COLLECTION AND DISCHARGE F WATER; LIABILITY FOR ICE FORMA-ON).
NE2d 142-148 (Ohio Ct App 1942).

escriptors: *Ohio, *Ice, *Diversion structures, teration of flow, Flow around objects, Water reading, Resonable use, Surface waters, Surface noff, Drainage waters, Oil industry, Discharge Vater), Water release, Runoff, Judicial decisions, ater law, Impoundments, Impounded waters, alls, Excavation, Surface drainage, Concrete uctures.
entifiers: *Negligence.

fendants maintained a gas station located on a eply sloping hill. To construct the station, the e had to be filled and graded, and retaining walls re constructed to divert water off the premises. intiff was injured when he slipped and fell on ice he walked on the sidewalk along the boundary of fendants' property at a point where the retaining ll caused water to flow into the street. Plaintiff ntended that in changing the grade of the lot and nstructing the retaining walls, the defendants verted the natural course of surface water and eated an unusually dangerous condition in freez- weather. In holding for defendants, the court ted that a property owner can only be held liable a dangerous condition if he has caused the ar-cial accumulation of surface water and has charged it upon the public way in considerably eater amount than would have been discharged m natural causes. The court held that the dence did not disclose any attempt to artificially cumulate surface water or divert it from a normal h. The dissenting opinion advocated liability of jury could find that water had merely been ar-cially discharged from the premises. (Hubener-rida)
70-08031

X V TICE (OWNERSHIP OF BED OF LAKE).

4 Misc 261, 298 NYS 441-455 (Sp Ct 1937).

scriptors: *New York, *Ownership of beds, oundary disputes, *Lake beds, Boundaries (Pro-ty), Legal aspects, Water law, Water rights, nds, Shores, Riparian rights, Relative rights, Ju-ial decisions, Land tenure, beds under water, merged lands, Lakes.

intiff and defendants owned riparian lands und a non-navigable lake. Their titles derived m letters patent from the state land office. Plain- brought this action to compel removal of cer-docks and piers and to enjoin defendants from king any further use of the pond on the ground t plaintiff was owner of the entire lake. Plaintiff tended that the letters patent to defendants' decessor in title did not convey any right or title he use of the lake. The court acknowledged that endants had acquired no rights or title by scriptive or adverse use but stated in holding for endants that the law presumes that riparian ners of lands adjoining fresh-water non-naviga- streams and lakes take title to the thread of the eam or the center of the body of water unless it arly appears that the adjacent waters are ex-ded from the conveyance. Where the grant is ned so as to touch the water, the bed of the eam or lake is presumed to be included. Thus the rds 'by the lake' or 'along the lake' contained in endants' letters patent conveyed title to the ter of the lake bed. (Hubener-Florida)
0-08033

PLES V TALIAFERRO (EXCLUDING PARIAN RIGHTS IN MORTAGE).
So 861-872 (Fla 1940).

scriptors: *Florida, *Riparian land, *Beds under er, *Boundary disputes, Judicial decisions, tutes, Real property, Banks, Riparian rights, vigable waters, Ownership of beds, Riparian waters, High water mark, Beds, State governments, Shores, Seashores, Relative rights, Wetlands, Shallow water, Bays, Gulfs, Boundaries (Property), Legal aspects.

Defendant mortgage purchased two parcels of land, one to uplands down to the high water mark of a bay and the other to the submerged lands adjoining the uplands. The uplands were mortgaged, and the description in the instrument referred to a plat which showed a narrow walkway paralleling the water's edge. Plaintiff mortgagee argued that this strip was included in the mortgage description, giving him riparian rights to the submerged land and overlying water. The court held that the conveyance of the submerged property by the Internal Improvement Fund to defendant was proper, and that the security for the mortgage did not include the walkway and the adjoining submerged lands. The court further held that defendant had validly separated the uplands and the riparian property. The dissent felt that the intent to separate the two parcels was not made sufficiently clear in the instrument, and that the riparian land was not reserved to defendant. A conveyance of land abutting a walkway was thought to convey rights to water bordering the walkway on the other side. The dissent further found that the submerged lands were not the character of those authorized for sale by the fund. (Douberley-Florida)
W70-08035

CITY OF BIRMINGHAM V LAKE (FISHING RIGHTS IN WATER WORKS RESERVOIR).
10 So 2d 24-28 (Ala 1942).

Descriptors: *Alabama, *Reservoir storage, *Ownership of beds, *Fishing, Judicial decisions, Water supply, Dams, Reservoir operation, Water conservation, Water resources, Water works, Water quality, Impared water quality, Water quality control, Abatement, Legislation, Water pollution control, Domestic water, Industrial water, Cities, Beds, Lake beds, Beds under water, Public rights, Non-navigable waters.

As a part of its water supply system, the municipality acquired title to the bed of a lake which was formed by impounding the waters of a river. To preserve the water quality the municipality enacted an ordinance forbidding entry on the water works property without the permission of city officials. Petitioner alleged fishing rights in the waters of the lake as a member of the public. The court held that fishing rights on non-riparian waters are an incident to ownership of the beds, and that the municipality when acting in its proprietary capacity was to be treated as any other property owner. The rights of the public to use city property was held to be confined to the uses for which it was held. The city had an interest in preserving the quality of its water supply, and the police jurisdiction of the city extended to the lake owned by the city outside its corporate limits. (Douberley-Florida)
W70-08036

GREAT HILL LAKE, INC V CASWELL (PRESCRIPTIVE RIGHTS OF LANDOWNERS IN ARTIFICIAL LAKES).
126 Conn 364, 11 A2d 396-398 (1940).

Descriptors: *Connecticut, *Developed waters, *Prescriptive rights, *Easements, Dams, Fishing, Boating, Swimming, Land tenure, Public rights, Relative rights, Water rights, Lakes, Recreation, Impoundments, Watercourses (Legal), Lake beds, Beds under water, Ownership of beds, Judicial decision, Legal aspects.

Plaintiff owned a dam which had created an artificial lake. Defendants owned land bordering on the lake and under the waters of the lake. Plaintiff brought action for a determination of the respective rights of plaintiff and defendants in the lake. Defendants argued they had acquired prescriptive rights to fishing, boating, bathing, watering of stock, cutting of ice and taking of water for domestic uses. The lower court held for defendants but the appellate court reversed, stating that where such individual uses are in common with uses made by the public, the individual must perform some act to the knowledge of the servient owner clearly indicating his individual claim in order to establish a prescriptive right. However, plaintiff's right to flowage over defendants' lands was only an easement and, except as to the portion of land which plaintiff owned, he had no right to keep defendants from using the lake for boating, fishing, or bathing. The claims of the defendants as to watering of stock, cutting of ice, and taking for domestic purposes were adverse uses of plaintiff's property and were rights that could be acquired by the user. (Hubener-Florida)
W70-08038

IN RE HUTCHINSON RIVER PARKWAY EXTENSION (RIPARIAN RIGHTS TO ACCRETION CAUSED BY ARTIFICIAL MEANS).
14 NYS2d 692-697 (Sup Ct 1939).

Descriptors: *New York, *Condemnation, *Riparian rights, *Accretion (Legal aspects), Boundaries (Property), Boundary disputes, Community development, Highway beautification, Judicial decisions, Legal aspects, Local governments, Proprietary powers, Public benefits, Riparian lands, Riparian waters, Watercourses (Legal), Condemnation value, Eminent domain, Public rights, Highways, Real property, Currents (Water).
Identifiers: Tide gates.

The City of New York had condemned for the extension of a parkway certain lands adjacent to the Hutchinson River. Portions of the condemned land had earlier accreted to the landowners along the river when the river's course was changed by the erection of tide gates. The issue was whether the city was liable to the landowners for the condemnation of this additional soil, the accretion of which was brought about by artificial means. The court held that the fact that the labor of other persons changed the current of the river and caused the accretion could not deprive the landowners of the right to it. The owners were entitled to a condemnation award for the land created by accretion and taken by the city. (Clarke-Florida)
W70-08041

VILLAGE OF FLEISCHMANNS V HYMAN (RELATIVE RIGHTS OF MUNICIPALITIES AND STATE AGENCIES TO REGULATE DAM MAINTENANCE).

164 Misc 175, 298 NYS 564-570 (Sp Ct 1937).

Descriptors: *New York, *Cities, *Dams, *Supervisory control (Power), Dam construction, Dam failure, Civil engineering, Structures, Municipal water, Public benefits, Local governments, State governments, Administrative agencies, State jurisdiction, Legislation, Building codes, Permits, Legal aspects, Judicial decisions, Bulkheads, Impoundments, Maintenance, Relative rights, Impounded waters.
Identifiers: *Dam maintenance.

Defendant maintained in an unsafe condition a dam within the plaintiff village. Plaintiff village sought an injuction to enforce a village ordinance relating: to the construction, maintenance, and operation of dams and; to bulkheads over waters within the village. The court ruled that plaintiff was required to prove both the existence of the dangerous condition and that the ordinance in question was a proper and authorized exercise of municipal power. In holding for defendant, the court held that the state conservation law vested in the state Superintendent of Public Works full and exclusive authority over structures impounding water. Since municipal corporations derive their power from statutes, they cannot of their own initiative abrogate other state statutes or adopt local laws and ordinances conflicting or inconsistent with the provisions or purposes of state legislation. In

prescribing a lesser penalty for an offense controlled by state law, the village had usurped the function of state provisions. (Hubener-Florida)
W70-08045

IN RE HUTCHINSON RIVER PARKWAY EXTENSION (CONDEMNATION VALUE OF RIPARIAN LAND).

33 NE2d 252 (NY 1941).

Descriptors: *New York, *Eminent domain, *Parks, *Condemnation value, Rivers, Highways, Road construction, Highway beautification, Judicial decisions, Legal aspects, Administrative agencies, Cities, Damages, Easements, Scenic highways, Land use, Riparian rights, Roads, Boundaries (Property), Condemnation, Compensation, Interest, Interest rate.

The city of New York acquired title to certain real property for the Hutchinson River Parkway Extension and for a park site. The property taken consisted of 19.6 acres fronting the Hutchinson River. The property taken amounted to approximately twenty-four per cent of claimant's total property. After the taking, claimant had two parcels of land remaining, which were separated by the parkway. The trial court awarded twelve cents per square foot for the portion of the claimant's property actually taken, but made no award for damage to the remaining land on each side of the parkway. The appellate division modified the award by increasing the rate of interest payable on the award. The Court of Appeals of New York affirmed. (Barnett-Florida)
W70-08058

CONFER V PIRMAN (BOUNDARY DISPUTE AS TO POND BED).
286 NYS 192-197 (App Div 1936).

Descriptors: *New York, *Boundary disputes, *Ponds, *Ownership of beds, Boundaries (Property), Lakes, Legal aspects, Water law, Water rights, Shores, Riparian rights, Relative rights, Judicial decisions, Land tenure, Lake beds, Beds under water, Submerged lands, Real property.

Plaintiff and defendants held adjoining land from a common grantor. The grantor had conveyed land 'on the east side' of a pond to defendants' predecessors in title. The grantor subsequently conveyed the rest of the land in the quarter to plaintiffs. Plaintiffs contended that defendants had acquired no title to land under water by their deed and that plaintiffs were the owners of the entire pond. Defendants contended that the deed in question conveyed title of the pond to the center line thereof. The lower court held for defendants and the appellate court affirmed, reciting only the facts of the case. The dissent, noting that the boundary in conveyances by several of defendants' predecessors in title had been described as 'running along the water's edge,' stated that the defendants had not acquired any lands west of the east side of the pond. (Hubener-Florida)
W70-08059

LOHR V UPPER POTOMAC RIVER COMM'N (POWER OF COMMISSION TO SUE AND BE SUED DID NOT APPLY TO TORT ACTIONS FOR NEGLIGENCE).
26 A2d 547-550 (Md 1942).

Descriptors: *Maryland, *State governments, *Administrative agencies, *Public rights, Administration, Legislation, Adjudication procedure, Flood control, Water resources development, Judicial decisions, Legal aspects, Third party effects, Political aspects, State jurisdiction.

Plaintiff brought suit in tort for injuries sustained in an automobile accident allegedly caused by the negligence of defendant river commission's employees in placing rocks and debris on a public highway. The court, in holding for defendant, stated that it was within the power of the state to establish a district for the control of state waters and to insure adequate water supplies and flood control. As a governmental agency performing a governmental function, defendant shared the state's immunity from suit. The statutory words empowering the commission to sue and be sued applied only to such suits as were necessary to carry out the purposes for which the commission was created. A tort action could not be maintained where no authorization was given to the commission or the state to provide funds to pay damages in a tort action. (Hubener-Florida)
W70-08061

COMMONWEALTH V DOUGHERTY (POLICY BEHIND LICENSING OF PLUMBERS).
For primary bibliographic entry see Field 05G.
W70-08063

TOWN OF PURCELLVILLE V POTTS (REASONABLE USE AND DIVERSION OF WATERS FROM A NATURAL STREAM).
For primary bibliographic entry see Field 04A.
W70-08064

BARCUS V BLANCHARD (OWNERSHIP OF FORMER LAKE BED).
135 NJ Eq 533, 39 A2d 499-505 (1944).

Descriptors: *New Jersey, *Ownership of beds, *Beds under water, *Boundary disputes, Lake beds, Streambeds, Riparian rights, Boundaries (Property), Islands, Lakes, Legal aspects, Judicial decisions, Dams, Spillway gates, Reservoirs, High water mark, Ponds, Real property.

A real estate company conveyed land to defendant which contained the marshy basin of a former artificial pond. The basin was traversed by a stream which had formerly been dammed to create the pond. The deed from the real estate company's grantor had expressly conveyed the land to the edge of the lake at the time of conveyance. Defendant began dredging operations in the basin to create a reservoir. Plaintiff, a descendant of the original grantor, sought an injunction to halt the dredging claiming ownership of the basin. Defendant also claimed title to the bed. In holding for plaintiff, the court acknowledged the rule that without express words of exclusion, a conveyance of lands abutting upon an artificial lake ordinarily conveys title to the medium filum of such lake. However, the words of the grant and the intentions of the parties should also be considered in determining whether title to submerged land had passed. The court, in construing the deed, found it conveyed title only to land extending to the height of the lake at the time of the original conveyance. The court found persuasive that at the same time the original grantor had conveyed adjoining land extending title by express provision to the middle of the pond. (Hubener-Florida)
W70-08066

MCGAHHEY V MCCOLLUM (USE OF A NON-NAVIGABLE WATERCOURSE).
179 SW2d 661-664 (Ark 1944).

Descriptors: *Non-navigable waters, *Arkansas, *Navigable waters, *Boundaries (Property), Reasonable use, Legal aspects, Judicial decisions, Ownership of beds, Riparian rights, Non-consumptive use, Recreation, Fishing, High water mark, Watercourses (Legal), Water level fluctuations, Lakes, Lake shores, Hunting, Waterfowl, Relative rights, Usufructuary right.

Suit was brought to enjoin defendants from interfering with plaintiffs' use and enjoyment of a certain lake for hunting, fishing and other purposes. The trial court found that the lake had never been used for commercial navigation and was non-navigable for any purpose. The court also found that defendants, as the owners of the entire body o land surrounding the lake, were also the owners o the land underlying the lake, their opinion being based on the law of Arkansas that a riparian owne on a non-navigable stream owns to the center of it The issue on appeal was whether the lake was in fact navigable. If it was navigable, defendant owned only to the high water mark. The cour stated that to be navigable, a watercourse mus have a useful capacity as a public highway of trans portation. The lake in question was found to b non-navigable, and consequently the trial court' holding that plaintiffs were not entitled to the us of the lake as a matter of right was affirmed. (Bar nett-Florida)
W70-08068

WINANS LAKE HILLS CORP V MOOR (RIGHTS TO RECREATIONAL USE OF POND).
284 Mich 688, 280 NW 81-83 (1938).

Descriptors: *Michigan, *Farm ponds, *Prescrip tive rights, Lakes, Lake shores, Recreation, Rela tive rights, Riparian rights, Land use, Land tenure Water utilization, Fishing, Contracts, Judicial deci sions, Legal aspects, Boundaries (Property), Com peting uses, Boating, Usufructuary right.

Defendants owned land abutting on a private non navigable pond. Defendants' predecessors in titl had conveyed away all rights to use of the pond ex cept for watering of stock, cutting of ice, and draw ing water for domestic purposes. Plaintiff corpora tion, owner of the pond, sought to restrain defen dants' use of the pond for boating and fishing pur poses. Defendants claimed to have acquired rights by prescription or estoppel, to use the lake fo boating and fishing purposes since they had beer doing so for several years. The court granted the in junction holding that the evidence did not establis adverse use by defendants. Such use of the lake a defendants made was by permission of the plaintiff and their predecessors in title. (Hubener-Florida)
W70-08070

WEINBURGH V SAIER (NATURAL STREAMS AS PROPERTY BOUNDARIES).
6 NW2d 921-923 (Mich 1942).

Descriptors: *Michigan, *Boundaries (Property) *Streams, *Boundary disputes, Land tenure, Judi cial decisions, Meanders, Rivers, Beds, Land ap praisal, Remedies, Overflow, Bank erosion, Acre age, Legal aspects, Ownership of beds, Real pro perty.
Identifiers: *Meander line, *Homesite.

Defendant land vendor owned a parcel of land bor dered on two sides by a river. Plaintiff vende purchased two residential lots from defendan which bordered this river. Each lot was supposed t contain 8 acres. After purchase, plaintif discovered that neither of his lots consisted of acres, and sued for reformation of the contract. De fendant claimed that the acreage should be com puted to the meander line of the stream whic would then give the plaintiff 8 acres per lot. Th court held that while abutting property runs to th meander line of a stream, it is not customary whe figuring lots for homesites to also include lan under water. Plaintiff was correct in not computin his acreage to the meander line, and consequentl the court reformed the contract as requested. (Si serson-Florida)
W70-08071

JASPER V WORCESTER SPINNING AN FINISHING CO (ACTION TO REGISTER LAN WITH APPURTENANT EASEMENT FOR AC CESS TO WATER).

318 Mass 752, 64 NE2d 89-94 (1945).

Descriptors: *Massachusetts, *Easement *Prescriptive rights, *Land tenure, Mills, Pipe Water supply, Conduits, Cities, Judicial decision

gal aspects, Streams, Boundaries (Property), ater rights, Riparian rights, Structures, Water lization, Industrial plants, Water conveyance, ght-of-way, Real property, Relative rights, nals.

vo parcels of land were owned at one time by a nufacturing concern. A waterway ran through e of the parcels, and a canal from that waterway s used to bring water to the adjacent parcel. on bankruptcy the parcels of land were sold to arate individuals. Petitioner wished to register e to the parcel of land he purchased from the nkruptcy trustee, including as appurtenant reto an easement to use and enjoy a supply of ter upon the premises of the respondent, rchaser of the other parcel, and to maintain a nduit for the flow of said water to his land. The urt held that where a landowner installs water e, drain, or other physical arrangements on part his land for the benefit of another part, the fact t severance of title of the dominant and the ser- nt estate is effected by simultaneous instruments es not prevent the existence of an easement. Re- tration of the land with the easement was al- ved. (Barnett-Florida)
70-08072

TY OF ELKHART V CHRISTIANA HYDRAU- CS, INC (ACTION AGAINST CITY TO TERMINE RIGHT TO TAP A MILLPOND D MAINTAIN A DAM IN CREEK).
NE2d 353-359 (Ind 1945).

scriptors: *Indiana, *Mill dams, *Water supply, iparian rights, Cities, Dams, Judicial decisions, gal aspects, Reasonable use, Prior appropriation, undaries (Property), Water works, Easements, ter rights, Appropriation, Relative rights, Water lization, Hydroelectric power, Hydroelectric nts, Prescriptive rights, Land tenure, Real pro- ty, Diversion, Natural flow, Pumping plants.

fendant city was the successor to the grantee of eed which gave certain realty for the purpose of talling a pumping station. The deed also gave the of water flowing in a creek which passed the lty. The deed reserved to the grantor a right to intain a millpond situated on the realty and the nt to use the water from same for the production power. Plaintiff, successor in interest of the gran- , brought suit to enjoin the city from tapping the lpond and to prevent the excessive utilization of creek water. Plaintiff claimed such actions inished his supply of water. The court held for intiff stating that the defendant did not have the nt to draw water from the pond, or to maintain a n in the creek below the pond, in such a way as thereby decrease the power available to the intiff. An upper riparian owner may not use or ert stream water in such a way as to render it vailable for the use of a lower riparian proprie- The court also rejected defendant's contention t it had acquired a prescriptive right to maintain rock dam. (Barnett-Florida)
0-08073

RON CANAL AND HYDRAULIC CO V FON- INE (RIGHT TO RECREATIONAL USE OF MMED WATER BY RIPARIAN OWNERS).
Ohio App 93, 50 NE2d 897-902 (1943).

scriptors: *Ohio, *Usufructuary right, *Riparian ts, *Dams, Lakes, Water storage, Reasonable , Lake beds, Fishing, Boating, Non-navigable ers, Natural streams, Water utilization, Water- rses (Legal), Impoundments, Dam construc- , Legal aspects, Dam sites, Judicial decisions, ative rights.

intiff was the proprietor of a dam on a non- igable stream. The dam had created a large lake ch defendant riparian owners used for fishing boating. Plaintiff, who held title only to the site area, brought this action to restrain the de- dants, individually and collectively, from using lake for fishing and boating. The court acknowledged that there was no public right to fish or boat in a natural, non-navigable lake. However, the court held for defendants stating that a proprietor of a dam on a non-navigable stream does not acquire ownership of water stored behind his dam. The water, unlike land, is not property and not the subject of ownership. The proprietor acquires a usufructuary right to the water and is entitled to make reasonable use of it. Plaintiff's right to flowage, storage and withdrawal of water from the dammed area did not also include exclusive fishing and boating privileges as incident and appurtenant to the water rights. (Hubener-Florida)
W70-08074

STANZE V MEIER (INTERFERENCE WITH THE OPERATION OF DRAINS).
44 NE2d 360-361 (Ohio Ct App 1942).

Descriptors: *Ohio, *Drains, *Subsurface drains, *Waste water disposal, Conduits, Pipes, Relative rights, Outlets, Sewers, Tile drains, Drainage effects, Drainage practices, Water policy, Riddance (Legal aspects), Water quality, Public health, Wastes, Effluents, Solutes, Judicial decisions, Legal aspects.

Without summarizing the facts of the case or substantially identifying the parties to the suit, the appellate court upheld a trial court injunction and ordered defendant not to destroy, alter or obstruct the operation of a cellar drain upon his premises. The court also sustained an injunction ordering plaintiff to refrain from using his basement drain for the disposal of wash water or for other domestic purposes, and to work out an agreement with defendant for disposal of wash water through a common drain on defendant's premises. (Hubener-Florida)
W70-08076

RESERVOIR RECREATION CORP V HODDER (PROPERTY RIGHTS IN BEDS UNDER WATER).
29 NE 2d 913-915 (Mass 1940).

Descriptors: *Massachusetts, *Reservoirs, *Riparian rights, *Beds under water, Highwater mark, Riparian waters, Recreation, Wildlife, Landfills, Structures, Riprap, Lakes, Banks, Lake beds, Recreation facilities, Swimming, Public health, Reservoir operation, Social aspects, Construction, Judicial decisions, Legal aspects, ownership of beds, Real property, Docks, Relative rights, Usufructuary right.

Plaintiff corporation was organized to encourage aquatic enjoyment to promote the study and propagation of wildlife and to provide for recreation and social enjoyment of its members. Plaintiff owned land covered by the waters of a lake to the high water mark. Defendant owned land above the high-water mark. Defendant constructed and maintained a dock, float, wall and fill which allegedly encroached on plaintiff's property. Plaintiff brought action to compel the removal of these structures. The court found the maintenance of the structures complained of constituted a continuing trespass against the plaintiff for which a mandatory injunction would issue even though the damage might be slight and the expense of removal disproportionate. (Barnett-Florida)
W70-08077

UNITED STATES LEATHER CO V CITY OF LYNN (TITLE TO AND BOUNDARIES OF SUBMERGED LAND).
199 NE 313-315 (Mass 1935).

Descriptors: *Massachusetts, *Ponds, *Boundaries (Property), *Ownership of beds, Cities, Mills, Judicial decisions, Legal aspects, Contours, Elevation, Riparian rights, Obstruction to flow, Reasonable use, Prior appropriation, Mill dams, Structures, Pipes, Flow, Grants, Legislation, Great ponds, Surface waters, Boundary disputes, Real property.

Plaintiff petitioned to register title to a mill pond under a grant which was the subject of construction by the trial court. Petitioner asserted title in fee to the pond up to a water line of an elevation of 74, Lynn city base. Defendant-city claimed title in itself subject to the right of petitioner to use the pond at that elevation. The court traced the chain of title in the pond through 300 years and found that the grant made to petitioner was of the fee of the pond including all land within its borders, subject to the right of an unobstructed flow therefrom for mills on the stream below. The court further determined that contour 74 of the pond was not an arbitrary line, but was the water line at the elevation of the dam as regulated by an overflow pipe. (Barnett-Florida)
W70-08078

HOOD V MURPHY (Public right to fish in non-NAVIGABLE STREAM).
6 Div 862, 165 So 219-221 (Ala 1936).

Descriptors: *Alabama, *Fishing, *Non-navigable waters, *Ownership of beds, Streambeds, Boundaries (Property), Upstream, Navigable rivers, Fresh water, Federal government, Streams, Legal aspects, Judicial decisions, Remedies, Public lands, Public rights, Patents, Freshwater fish, Relative rights, Land tenure, Real property, Recreation demand.
Identifiers: *Injunction, Trespass.

A small, fresh-water stream passed through plaintiff's property. It appeared that fish were plentiful in this non-navigable stream, especially within plaintiff's boundary lines. Over plaintiff's protests, defendant entered the stream below plaintiff's property line and proceeded upstream within plaintiff's boundaries. Defendant then proceeded to fish, as he stood on the river bottom. Plaintiff sought to enjoin such fishing. Contending the state owned the river bed, defendant maintained that he had not actually trespassed upon plaintiff's property. The court, however, held that the state owned only navigable streambeds. The lands upon which non-navigable streams were located had once been public land, ceded to the United States. However, the federal government patented this land and passed title to patentees and their successors in ownership. The public had no right to fish in waters flowing over such land. Plaintiff, therefore, had exclusive fishing rights in the non-navigable stream. (Finman-Florida)
W70-08080

CITY OF SYRACUSE V GIBBS (STATE CONTROL OVER POTABLE WATER DISTRIBUTION).

258 App Div 405, 17 NYS2d 293-302 (Sup Ct 1940).

Descriptors: *New York, *Administrative decisions, *State jurisdiction, *Water supply, Community development, Equitable apportionment, Judicial decisions, Legal aspects, Legislation, Local governments, Preferences (Water rights), Public rights, Public benefits, Relative rights, State governments, Water rights, Administrative agencies, Water allocation (Policy), Water demand, Cities, Conduits.
Identifiers: *Public trust doctrine.

Defendant water commission issued an order forcing plaintiff city to allow a smaller village to tap into its water supply conduit. The village was to draw off up to 69 million gallons per year at a fixed rate payable to defendant. Plaintiff had obtained its right to use and consume the water of a particular lake by a series of state statutory grants. Plaintiff contended that these grants entitled it to operate without interference, and that defendant had no authority to issue such an order. The court held that the distribution of potable water is a right held in trust by the state for the benefit of all its inhabitants. Therefore, a state may not divest itself of control of rights held for the benefit of all the people. The commission was by statute delegated the

power to supervise the equal distribution of potable water to the residents of the state. However, the defendant commission was not given express statutory power to exercise ownership and dominion over the conduits constructed and owned by plaintiff, nor was it given statutory power to set specific rates which plaintiff must charge for the use of the conduits by the village. The commission's order was annulled. (Clarke-Florida)
W70-08082

EASTON V STATE (DAMAGES TO RETAINED PORTION OF LAND CAUSED BY USE OF APPROPRIATED PORTION).

245 App Div 439, 283 NYS 809-812 (App Div 1935).

Descriptors: *New York, *Springs, *Eminent domain, *Condemnation value, Subsurface waters, Wells, Underground streams, Underground, Road construction, Highways, Highway effects, Judicial decisions, Legal aspects, Water pollution, Water pollution effects, Groundwater, Civil engineering, Condemnation, Right-of-way, Relative rights, Land use, Compensation.
Identifiers: State governments, Condemnation.

Plaintiff landowner was awarded a fair amount of compensation for land taken by the state in the vicinity of a railroad crossing. Plaintiff continued to live on adjacent property and reserved the right to take water from a spring located on a portion of the appropriated land. The state constructed a new highway over the appropriated land and dirt and roily substances from the gutter percolated into the subterranean watercourses which fed the spring. The spring was rendered useless to plaintiff and he sought compensation for the damages accruing to the retained land. The court, in holding for plaintiff, stated that the damages had resulted from the initial taking of his land and the construction of the hiighway. Where land is taken without the consent of the owner, he is entitled to recover the market value of the property and any damages to the residue by reason of the use to which the appropriated part is put. (Hubener-Florida)
W70-08084

GROBART V PASSAIC VALLEY WATER COMM'N (PRESCRIPTIVE RIGHTS TO DIVERT WATER).

135 NJ Eq 38, 37 A2d 98-99 (1944).

Descriptors: *New Jersey, *Diversion, *Prescriptive rights, *Reasonable use, Judicial decision, Legal aspects, Routing, Riparian rights, Water works, Water demand, Water supply, Consumptive use, Preferences (Water rights), Domestic water, Priorities, Rivers, Remedies.

Complainants were owners of land bordering the Passaic River. They sought to enjoin defendant from abstracting water from the river above their lands. Defendant's defense was that it had title or a prescriptive right to the water arising out of continuous user of the water for twenty years. Defendant did not dispute complainants' right to prevent abstraction in excess of the prescriptive right, but argued that the amount of the user allowed should be the average of the twenty years use and not, as plaintiff alleged, the minimum amount used in any single year. The court, in holding for plaintiff, stated that the extent of a prescriptive right to divert water from a river could not exceed the lowest average daily abstraction of any one year. (Barnett-Florida)
W70-08085

GROBART V PASSAIC VALLEY WATER COMM'N (PRESCRIPTIVE RIGHT TO DIVERT WATER--COMPUTATION OF ALLOWABLE DIVERSION AMOUNT).
34 A2d 284-285 (N J Ch 1943).

Descriptors: *New Jersey, *Diversion, *Prescriptive rights, Reasonable use, Judicial decisions, Legal aspects, Routing, Riparian rights, Water works, Water demand, Water supply, Consumptive use, Preferences (Water rights), Domestic water, Priorities, Rivers, Usufructuary right.

Complainant, who owned land bordering on the Passaic River on which factory buildings were erected, sought an injunction against defendant's allegedly unlawful and injurious diversion of water at a point above her lands. Defendant claimed a prescriptive right based on adverse user of the waters for a period of at least twenty years. Objection was raised by complainant as to the method of computation and accuracy of the measurement of the amount of waters diverted by defendant. Defendant measured average daily flow through the meters for each month, then added the total of a twelve months' flow and divided the total by twelve. The court held that this method of computation was adequate, and that defendant had established an adverse user which had ripened into a prescriptive right to divert a daily average of water equaling 22.6 million gallons. However, the proofs had shown that defendant had exceeded that figure, and consequently complainant was entitled to an injunction against a greater diversion than 22.6 million gallons. (Barnett-Florida)
W70-08086

PAMRAPAU CORP V CITY OF BAYONNE (RELATIVE RIGHTS IN SUBMERGED LAND IN FRONT OF RIPARIAN PROPERTY).
8 A2d 835-837 (N J Ch 1939).

Descriptors: *New Jersey, *Ownership of beds, *Riparian rights, *Riparian land, Beds under water, Harbors, Water law, Condemnation, State governments, Local governments, Land tenure, Navigation, Docks, Piers, Judicial decisions, Legal aspects, Relative rights, Riparian waters, Land use, Leases, Grants, Compensation.

Plaintiff was a riparian owner of lots bordering on New York Bay. In 1886 defendant city, which then owned the lots, received through a state grant rights to use the land under water infront of the lots for public purposes such as construction of docks. The right was to continue as long as defendant owned the lots. Defendant subsequently sold the lots and plaintiff eventually acquired them. After plaintiff's acquisition, defendant attempted to lease the same submerged lands to defendant construction corporation for construction of a marine terminal. Plaintiff sought: (1) to remove the cloud upon his title to the lots caused by the lease; and (2) either an injunction against the construction of the terminal or damages for the deprivation of his riparian rights. The court ruled that defendant city had acquired an estate upon limitation in the grant from the state and by its conveyance of the upland lots lost the rights granted with respect to the submerged lands. Riparian owners hold pre-emptive rights to grants or leases of submerged lands in front of their uplands unless, after six month notice of a proposed state grant, the owner fails to apply for such a grant. On failure to so apply, such an owner is still entitled to compensation, since this riparian right is a property right. Defendant was given time to acquire complainant's rights either by purchase or condemnation. (Hubener-Florida)
W70-08088

MILLER V MILLER (PROPERTY RIGHTS IN ARTIFICIAL LAKES).
7 A2d 3 (Pa 1939).

Descriptors: *Pennsylvania, *Lakes, *Recreation, *Prescriptive rights, Easements, Boats, Swimming, Fishing, Legal aspects, Judicial decisions, Riparian rights, Ownership of beds, Artificial watercourses, Usufructuary right.

The owner of bathing, fishing and boating privileges in an artificial lake conveyed one-fourth interest in such privileges to another. The interest in the lake had been acquired by deed and prescrip tion. The Supreme Court of Pennsylvania, in a pe curiam decision, stated that these privileges give to the grantee and his assignee were the exclusiv property of them and their heirs. The court found that the owner of the land under the lake had no in terest in or to the granted rights. (Barnett-Florida)
W70-08089

BALTIMORE V BRACK (ACQUISITION OF EASEMENT BY CONDEMNATION).
3 A2d 471-476 (Md 1939).

Descriptors: *Maryland, *Cities, *Condemnation *Easements, Land tenure, Public rights, Publi health, Public utilities, Water works, Compensa tion, Regulation, Permits, Administration, Eminen domain, Local governments, Judicial decisions Legal aspects, Right-of-way, Economic impact Condemnation value, Economic feasibility Prescriptive rights, Remedies.
Identifiers: *Injunction (Mandatory).

Plaintiff purchased a tract of land through whic defendant city had run underground water mains The mains had been installed with the consent o plaintiff's predecessor in title; however, no licens had been executed and recorded, and the city hac granted no consideration for use of the land. Plain tiff sought an injunction to require removal of th utilities. The court held that unrecorded grants o easement could not pass to succeeding owners b parole and, apart from prescriptive rights, ease ments could only be acquired according to statuto ry requirements. The city had acquired only revocable license to use plaintiff's land and unti the utilities were removed or an easement acquire by condemnation, was liable to plaintiff fo reasonable compensation for use of the license However, reviewing a municipality's duty to supph sewage and water facilities, the court found that, i view of the harm which would result to the public, balancing of equities would not require removal o the utilities. The court granted the city time t acquire an easement by condemnatio proceedings. (Hubener-Florida)
W70-08091

MILLER V MILLER (RELATIVE RIGHTS TO USE OF ARTIFICIAL LAKE).

200 A 652-653 (Pa 1938).

Descriptors: *Pennsylvania, *Ownership of beds *Usufructuary right, *Artificial watercourses Docks, Beds under water, Piers, Lake beds, Lan tenure, Relative rights, Riparian rights, Recreation Remedies, Fishing, Boating, Swimming, Permits Water rights, Watercourses (Legal), DVELOPE WATERS, Permits, Recreation facilities.
Identifiers: *Trespass.

Defendants owned the land under the waters of a artificial lake. Plaintiff, who owned land abuttin on the lake, constructed a dock which protrude into the water. Defendants' agents tore down th dock and posted notices warning all people tha they might boat, bathe, and fish in the lake only i licensed by defendants' lessee. Plaintiff sought a injunction to prevent interference with their enjoy ment of the lake and also sought an accounting o the profits from exploitation by the defendants o fishing, boating and bathing privileges in the lake The court held that the part of the dock whic protruded into the lake was a trespass, and defen dants were justified in destroying it. However damages could be recovered for destruction of th part built on plaintiff's land. The court also recog nized that plaintiff had a one-fourth interest in th boating, bathing and fishing privileges in the lak and was entitled to an accounting of the proceed from the commercial use of such privileges by de fendants. (Hubener-Florida)
W70-08092

BAN V BUCKLIN (PRESCRIPTIVE RIGHT
MAINTAIN STRUCTURES BUILT ALONG
KE SHORELINE).

A 8-12 (NH 1936).

criptors: *New Hampshire, *Docks, *Prescrip-
rights, *Recreation facilities, Boundaries (Pro-
y), Piers, Public rights, Recreation, Navigation,
nt-of-way, Land tenure, Easements, Riparian
ts, Water rights, Boating, Fishing, Lakes, Land
Recreation demand, Legal aspects, Usufruc-
y right, Competing uses, Judicial decisions,
mming, Structures.

ntiff owned and operated a boys' camp on land
g a highway. On the opposite side of the
way were a narrow strip of land and then a
. Plaintiff's predecessor in title had erected a
ll wharf extending out into the lake. Plaintiff
added a boathouse and a diving structure near
wharf. Plaintiff brought action to establish a
criptive right to maintain these structures as
nst defendant who owned the strip of land
ween the lake and the highway. The defendant
ed for removal of the structures. The court held
, in order for plaintiff to count his grantor's
od of adverse use of the wharf in establishing a
criptive right, privity of estate was necessary
ween the grantee (plaintiff) and the grantor.
reover, each structure must have been erected
used adversely for the full 20 year period. The
od of acquisition could not begin when there
nothing to show appropriation of a site. The
rt found plaintiff entitled to the use of the wharf
not the boathouse. The diving tower, although
bstruction to navigation, did not invade defen-
's riparian rights. The court also held that
ntiff could not establish a public right to erect
structures without an express grant from the
lic. (Hubener-Florida)
0-08094

TSON V HOLLAND (POWER OF STATE TO
ANT DRILLING RIGHTS ON SUBMERGED
EREIGN LANDS).
o 2d 388-394 (Fla 1944).

criptors: *Florida, *Ownership of beds,
ases, *Navigable waters, Public benefits, Judi-
decisions, Legal aspects, Land tenure, Legisla-
, Motivation, Pollution, Public rights, Recrea-
, Relative rights, Social aspects, Social needs,
e governments, Watercourses (Legal), Oil
s, Natural use, Jurisdiction, State jurisdiction,
inistrative agencies, Oil industry.
tifiers: *Trust doctrine.

appellant Attorney General of Florida sought
nctive relief and cancellation and recission of
il lease granted by the Trustees of the Florida
mal Improvement Fund. The lands leased were
er navigable waters, and the Attorney General
ended that the lease thereof was in conflict
the trust doctrine. He also contended that
e was no state constitutional or statutory
ority for such lease. The court held that subject
e authority of Congress over navigable waters,
subject to vested private property interests, the
has power to legislate concerning the disposi-
and use of lands beneath navigable waters
in the territorial limits of the state. Such
lative acts must be within the bounds set by the
constitution. It has long been the established
ic policy that the state may, if done in ac-
ance with the appropriate statutes, part with
ions of its land under navigable waters. Statutes
empower the Trustees to lease land under state
rs to individuals for drilling purposes. The
s of the lease provided safeguards against ob-
onable operation of the wells and possible pol-
n. The decree appealed was affirmed. (Price-
ida)
0-08108

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, COASTAL FLOODING OF NORFOLK, VIRGINIA.
Corps of Engineers, Norfolk, Va.
For primary bibliographic entry see Field 04A.
W70-07909

6G. Ecologic Impact of Water Development

THE ENVIRONMENTAL DISPOSITIONS OF ENVIRONMENTAL DECISION-MAKERS,
California Univ., Berkeley.
Kenneth H. Craik.
Annals of the American Academy of Political and Social Science, Vol 389, May 1970. p 87-94, 27 ref.

Descriptors: *Decision making, *Environment, *Psychological effects, *Social aspects, Attitudes, Social values.
Identifiers: *Environmental disposition, Environmental decision maker.

A new interdisciplinary field of research has recently emerged which studies how persons comprehend the everyday physical environment, how they use it, how they shape it and how they are shaped by it. In seeking an objective understanding of the behavioral aspects of the total personal-societal-environmental system, professional environmental decision-makers, such as architects, urban planners and natural-resources managers, are strategic choices for psychological study. Within this context of environmental design and management, research is being directed toward clarifying the implicit assumptions about environmental behavior held by decision-makers, overcoming social and administrative distances from clients, and conducting systematic follow-up evaluations of the behavioral consequences of planning and design decisions. However, subtle and precise study of man-environment relations will require the development of psychological techniques providing a comprehensive and differentiated description of any person's orientation to the everyday physical environment. Methods for measuring individual differences in environmental dispositions are reviewed and their potential usefulness for advancing knowledge of the interplay between human behavior and the physical environment is illustrated. (Davis-Chicago)
W70-07993

07. RESOURCES DATA

7A. Network Design

NATIONAL SYSTEM FOR WATER DATA,
Geological Survey, Washington, D.C. Water Resources Div.
Russell H. Langford, and George H. Davis.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7392, p 1391-1401, July 1970. 11 p, 2 fig.

Descriptors: *Data collections, *Hydrologic data, *Data storage and retrieval, *Information retrieval, Data processing, Documentation, Legislation, Governments, Libraries, Publications, Federal Government.
Identifiers: Data management, National system for water data, Office of Water Data Coordination.

Bureau of the Budget Circular A-67, August, called for coordination of certain water data acquisition by Federal agencies. The Department of the Interior's Office of Water Data Coordination was given responsibility to: (1) Design and operate a National Water Data Network; (2) coordinate national network and specialized water data activities and prepare an annual Federal Plan for water data acquisition; and (3) maintain a catalog of information on water data, and on Federal activities planned or conducted to acquire such data, and to organize network data. The Catalog of Information on Water Data is a file of information on water data acquisition activities and Indexes are published. A level of information approach to network design has three informational levels: Level I, base level for national and regional planning; Level II, subregional planning objectives; Level III, local operation and management objectives; the accounting element of the Level I, streamflow and stream quality was designed. An Interior Water Data System was developed and will be expanded to non-Interior Federal agencies. Field coordination initially will involve four field coordinators to review agency plans and needs for water data. (Knapp-USGS)
W70-07663

THE DESIGN OF NOZZLE NETWORKS FOR THE SIMULATION OF RAINFALL,
Imperial Coll. of Science and Technology, London (England).
M. J. Hall.
Journal of Hydraulic Research, Vol 7, No 4, p 449-483, 1969. 35 p, 12 fig, 3 tab, 6 ref.

Descriptors: *Rainfall simulators, *Hydraulic models, *Rainfall-runoff relationships, Artificial precipitation, Simulated rainfall, Instrumentation, Nozzles, Rainfall disposition, Distribution patterns.
Identifiers: Nozzle networks.

A method is given for designing a network of nozzles to generate artificial rainfall. A simple design of swirl-type nozzle was devised and the effect of the internal geometry of the swirl-producing component of this nozzle on its dispersion properties is illustrated. Statistical coefficients are used as measures of the uniformity of the application pattern from a network of nozzles. A method of generating the patterns from networks with different spacings of nozzles by using the distribution of depths from one nozzle is outlined, and the details of a computer program for performing the calculations are presented. (Knapp-USGS)
W70-07674

HYDRODYNAMIC STUDIES OF TIDE GAUGES,
Liverpool Univ. (England). Dept. of Civil Engineering.
A. Roy Halliwell, and John G. Perry.
Journal of Hydraulic Research, Vol 7, No 4, p 485-517, 1969. 33 p, 12 fig, 2 tab, 11 ref.

Descriptors: *Tidal waters, *Gaging stations, *Water levels, *Instrumentation, Gages, Stream gages, Calibrations, Water measurement, Laboratory tests.
Identifiers: Tide gages.

When tide gages of the float and well type are situated so that there is a flow past them, an error is introduced into their readings as a result of the flow. A relationship was developed for the well orifice pressure coefficient in terms of Reynolds number, Frounde number and two geometric ratios. The relationship was investigated by model tests on various tidewell end-shapes and orifice configurations. The wells giving least error from this effect are found to be the shrouded cone and the standard American gage. A study was made of the magnitude of current error and several alternatives for eliminating it are suggested. (Knapp-USGS)
W70-07675

MONTANA TELEMETRY SYSTEM,
Soil Conservation Service, Bozeman, Mont.; and Montana State Univ., Bozeman. Dept. of Engineering.
Phillip E. Farnes, and John Rompel.

Proceedings 37th Annual Meeting of Western Snow Conference, April 15-17, 1969, Salt Lake City, Utah; printed by Colorado State University, Fort Collins, p 102-107, 1969. 6 p, 4 fig.

Descriptors: *Remote sensing, *Telemetry, *Snow surveys, *Montana, Data collections, Instrumentation, Streamflow forecasting.
Identifiers: Snow survey telemetry.

The snow survey telemetry system in use near Bozeman, Montana consists of 3 remote data sites, 2 repeaters, and a base station. Propane generators power the repeater station. Four dry cell batteries provide a 1-year power supply for the remote sites. A clock at the site initiated hourly transmission of snow pillow, total precipitation, and air temperature data. Snow pillow and precipitation data were obtained from potentiometers attached to Leupold-Stevens Type F recorders. A thermistor bridge is used as a temperature sensor. Received data are recorded automatically on Esterline-Angus strip chart recorder at the Snow Survey office in Bozeman. Pressure transducers were substituted in the hydraulic system to replace the potentiometers. Data can most advantageously be transmitted in analog form, allowing the remote site equipment to be kept as simple (hence trouble free and low cost) as possible. Punched paper tape was chosen as the most economical form of data record for computer input. All equipment is solid state. The automatic call-up sequence can be initiated by an external timer or a noon or midnight or both by the digital clock in the digital data recorder. With continuous data, need for regular snow surveys on specific dates is reduced. Field measurements can be adjusted to first-of-month or mid-month readings by comparing with telemetered data. Early season measurements can be greatly reduced as correlation between pillows and snow courses is developed. Accurate data on melt, heavy precipitation, and other unusual climatic occurrences can be noted as they occur. Accurate measurements of total precipitation can be obtained by using both snow pillows for snowfall and precipitation gages for rainfall and combining them. (See also W70-07530). (Knapp-USGS)
W70-07678

7B. Data Acquisition

APPLICATIONS OF AIRBORNE REMOTE SENSING TECHNOLOGY,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
Ralph W. Kiefer, and James P. Scherz.
ASCE Proceedings, Journal of the Surveying and Mapping Division, Vol 96, No SU 1, Paper 7225, p 57-80, Apr 1970. 24 p, 19 fig, 44 ref.

Descriptors: *Remote sensing, *Aerial photography, Radar, Thermal radiation, Photogrammetry, Infrared radiation, Water pollution, Soil surveys, Terrain analysis, Monitoring, Planning.
Identifiers: Side-looking radar.

Recent developments in aerial photography, such as color film, color infrared film, and multiband photographic systems, have greatly increased the amount of useful information obtainable from aerial photographs. Remote sensing instruments that operate in different parts of the electromagnetic spectrum from the human eye and photographic sensors can detect many things beyond the scope of human and photographic sensors. Thermal imagery can detect thermal pollution entering streams. Side-looking airborne radar can map terrain day or night, almost without regard for weather conditions. Remote sensing instruments having civil engineering applications are described herein. The emphasis is on photography, thermal imagery, multispectral imagery, and side-looking airborne radar. Applications of airborne remote sensing technology to soils mapping, water pollution detection and monitoring, and urban and regional planning are illustrated. (Knapp-USGS)
W70-07649

FLOW ANALYSIS OF LARGE TRIANGULAR WEIR,
Agricultural Research Service, Chickasha, Okla.
Donn G. DeCoursey, and Bruce J. Blanchard.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7405, p 1435-1454, July 1970. 20 p, 9 fig, 3 tab, 11 ref, 5 append.

Descriptors: *Weirs, *Flow measurement, *Gaging stations, *Alluvial channels, *Calibrations, Open channel flow, Streamflow, Instrumentation, Unsteady flow, Stream gages, Stage-discharge relations.
Identifiers: Large triangular weirs.

V-notch weirs have often been used to stabilize the ratings of streamflow stations in unstable alluvial channels. The theoretical development and interaction of weir flow, submergence, and unsteady flow are discussed. Two different equations are derived to describe weir flow. The equations are more accurate than conventional weir flow equations. If the weir rating is based upon both the static and velocity heads, the effect of submergence is one of a superposition of flows. The rate of change of stage does not fully define unsteady flow. (Knapp-USGS)
W70-07660

STREAMFLOW FORECASTING, A VITAL ELEMENT IN WATER MANAGEMENT,
Bureau of Reclamation, Salt Lake City, Utah.
David L. Crandall.
Proceedings 37th Annual Meeting of Western Snow Conference, April 15-17, 1969, Salt Lake City, Utah; printed by Colorado State University, Fort Collins, p 92-96, 1969. 5 p, 4 fig.

Descriptors: *Streamflow forecasting, *Colorado River, *Snow surveys, *Reservoir operation, Optimization, Multiple-purpose projects, Hydroelectric power, Irrigation, Recreation, Water management (Applied), Planning.

Within the constraints of operating the reservoirs of the Colorado River Storage Project to meet Compact delivery requirements for fish and wildlife, float boaters and other recreationists, to control floods, help highway bridge builders, and aid water deliveries for communities, farms, and industries, there is still opportunity to attempt optimum use of the available water for power production. The bulk of the cost of the storage project is being paid by power production. Project water use comes in the form of electric energy over a wire. Project power income is now about $20 million per year. With the combined effect of streamflow plus the head versus volume relationship being unique at each reservoir with a powerplant, the distribution of storage among the reservoirs is aimed at developing maximum systems energy and capacity. The streamflow forecasting method used by the Bureau of Reclamation is based on a correlation of streamflow at a particular site with the accumulated precipitation at selected gaging stations plus snow depths at specific courses within the contributing drainage basin. Above Glen Canyon Dam, the Bureau uses precipitation stations and 48 snow courses. Emphasis is placed on the application of the probability of the forecast runoff deviating from the actual runoff. Most management decisions recognize a deviation range exceeded less than one out of ten times in the past. (See also W70-07530) (Knapp-USGS)
W70-07677

GEOLOGICAL STRUCTURES OF THE RED SEA AREA INFERRED FROM SATELLITE PICTURES,
North American Rockwell Corp., Thousand Oaks, Calif. Science Center.
Monem Abel-Gawad.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea; published by Springer-Verlag New York Inc. p 25-37, 1969. 13 p, 5 fig, 15 ref.

Descriptors: *Remote sensing, *Satellites (Artificial), *Geology, *Oceanography, Brines, Mineralogy, Sea water, Water chemistry, Water temperature, Photography, Aerial photography, Faults (Geology), Fractures (Geology), Exploration, Surveys, Geophysics.
Identifiers: *Red Sea, Hot Brines.

Photographs of the Red Sea area taken during the Gemini earth-orbiting missions show the gross structural relationship between the highlands of the Arabian-Nubian shield, the sediment-filled Red Sea 'graben' system and the marginal sedimentary cover with large areas of volcanic activity. Among five major systems of faults affecting the Arabian-Nubian massif, three systems trending N, NW, and WNW appear to have a profound influence on the structure of the Red Sea. The other systems oriented NE and E are more evident in the Gulf of Aden area. The fissure systems control the coastal outlines, and major physiographic features such as deptessions, drainage lines, and much of the Nile Valley. The relative positions of two pairs of shear zones intersecting the northern part of the Red Sea provide additional geological evidence consistent with the relative northward movement of Arabia some 150km. The regional fissure system disposition may be interpreted in terms of a combination of shear and tension producing conjugate fissures and gravity faults. (See also W70-07394) (Knapp-USGS)
W70-07680

THE PERFORMANCE OF THREE TYPES OF LEAF-WETNESS RECORDERS,
Israel Meteorological Service, Bet-Dagan. Agrometeorological Div.
For primary bibliographic entry see Field 02I.
W70-07774

THE QUANTITATIVE DESCRIPTION OF SOIL MOISTURE STATES IN NATURAL HABITATS WITH SPECIAL REFERENCE TO MOIST SOILS,
University Coll. of Wales, Aberystwyth.
For primary bibliographic entry see Field 02G.
W70-07800

METHODS FOR COLLECTION AND ANALYSIS OF WATER SAMPLES,
Geological Survey, Washington, D.C.
F. H. Rainwater, and L. L. Thatcher.
For sale by Superintendent of Documents, U Government Printing Office,Wash, D C - 2040 Price $1.50. US Geological Survey Water-Suppl Paper 1454, 1968 (Fifth printing). 301 p, 17 fig, tab.

Descriptors: *Analytical techniques, *Sampling *Water quality, *Water analysis, Data collection Hydrologic data, Water chemistry, Laborator tests, On-site tests, Instrumentation, Water prope ties.
Identifiers: Water sampling, U. S. Geological Su vey.

This manual contains methods used by the U. Geological Survey to collect, preserve, and analyz water samples. Throughout, the emphasis is on o taining analytical results that accurately descril the chemical composition of the water in sit Among the topics discussed are selection of sar pling sites, frequency of sampling, field equipmer preservatives and fixatives, analytical techniques water analysis, and instruments. Seventy-sev laboratory and field procedures are given for dete mining 53 water properties. (Knapp-USGS)
W70-07911

DETERMINATION OF NITRATE IN WATEI WITH THE NITRATE-SELECTIVE ION ELE TRODE,
Wisconsin Univ., Madison. Dept. of Soils.
D. R. Keeney, B. H. Byrnes, and J. J. Genson.
Analyst, Vol 95, p 383-386, 1970. 3 tab, 7 ref.

criptors: *Analytical techniques, *Electrodes, trates, Groundwater, Surface waters, Analysis, , Nitrogen, Wells.
tifiers: *Nitrate-selective ion electrode, Orion earch Corporation, Cambridge (Mass), Ion trode, Steam distillation tests, Phenol-lphonic acid tests, Orion Model 404, Specific meter.

results obtained with nitrate-selective ion elec-e showed no significant deviations due to inter-nce from other ions. Recovery of nitrate gen exceeded 83%, being somewhat lower in parison with phenoldisulphonic acid and m-distillation procedures. The electrode ap-s to be best suited for routine analyses of wells surface waters having nitrate nitrogen concen-ons near or above 10 milligram/liter. (Wilde-consin)
-08105

MPLE METHOD OF ASSESSING THE AN-L PRODUCTION OF STREAM BENTHOS,
erloo Univ. (Ontario). Dept. of Biology.
. N. Hynes, and Mary J. Coleman.
nology and Oceanography, Vol 13, No 4, p -573, 1968. 2 tab, 12 ref.

criptors: *Streams, *Benthos, *Productivity, nual, *Methodology, Benthic fauna, Sampling, ning waters, Standing crop, Biomass, Tur-ers, Invertebrates, Insects, Stoneflies, Mathe-cal studies, Streambeds.
tifiers: Afon Hirnant (Wales), Speed River nada), Baetis vagans, Unionidae, Univoltine, nata, Megaloptera, Plecoptera.

problems involved in estimating the produc-y of running water are discussed. It is possible calculate the annual production of stream hic animals from data obtained from a series of l quantitative samples collected at intervals ng the year. The method is dexcribed and its ations and short-comings discussed. The data ved from the Afon Hirnant (Wales) used in er papers are reworked together with similar from the same stream for the year 1959-1960. ding biomass, production, and turnover ratio calculated for both years, and the differences ween the values are discussed. Figures obtained the Afon Hirnant, an unproductive stream, compared with those of the richer, hard-water, d River (Ontario) and with data obtained by ers for Baetis vagans using the instantaneous th rate method for estimating production. At ent, this appears to be the only simple and ct method for estimating production. Because s simplicity it could be widely applicable in ob-ng approximate estimates of the turnover s of different types of streams. (Jones-Wiscon-

-08113

. Evaluation, Processing and Publication

LICATIONS OF AIRBORNE REMOTE SING TECHNOLOGY,
onsin Univ., Madison. Dept. of Civil Engineer-

primary bibliographic entry see Field 07B.
-07649

IPUTER DETERMINATION OF FLOW OUGH BRIDGES,
s of Engineers, Davis, Calif. Hydrologic En-ering Center.
primary bibliographic entry see Field 08B.
-07659

IONAL SYSTEM FOR WATER DATA,
ogical Survey, Washington, D.C. Water urces Div.
primary bibliographic entry see Field 07A.
-07663

THE RED SEA -- A GEOPHYSICAL BACKGROUND,
Newcastle-upon-Tyne Univ. (England). School of Physics.
R. W. Girdler.
In: Hot Brines and Recent Heavy Metal Deposits in the Red Sea, published by Springer-Verlag New York Inc, p 38-58, 1969. 21 p, 8 fig, 1 tab, 93 ref.

Descriptors: *Geophysics, *Faults (Geology), Brines Mineralogy, Hot springs, Sounding, Exploration, Geology.
Identifiers: *Red Sea, Continental movements.

The history and evolution of the Red Sea are considered in the light of the continental movement of Africa and Arabia. The relevant palaeomagnetic data pertaining to the latter are summarized. The Red Sea developed in phases, and it is likely that these correspond in time to phases of continental drift. The geophysical data for the Red Sea are summarized by considering the Red Sea in three parts; the northern Red Sea (north of 25 deg N), the central Red Sea (17 deg to deg N),AND SOUTHERN Red Sea (south of 17 deg N). Structural differences from to south are noted. Finally a summary is given for the evolution of the Red Sea taking into account geophysical and geological data for the whole Afro-Arabian region. (See also W70-07394) (Knapp-USGS)
W70-07681

UTILIZATION OF PHYSICAL AND MATHEMATICAL MODELS IN MARINE WATER RESOURCES RESEARCH, PLANNING AND MANAGEMENT,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02L.
W70-07801

FIELD SITES AND SURVEY METHODS,
Johns Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering Science.
For primary bibliographic entry see Field 05C.
W70-08123

08. ENGINEERING WORKS

8A. Structures

AIR TESTING SANITARY SEWERS,
Bloomington, Minn.; and Cherne Industrial, Inc., Hopkins, Minn.
For primary bibliographic entry see Field 05D.
W70-07715

USE OF COMPUTERS IN DESIGN OF SANITARY SEWER SYSTEMS,
Polytechnic Inst. of Brooklyn, N.Y.
For primary bibliographic entry see Field 05D.
W70-07732

DESIGN AND CONSTRUCTION OF THE WORLD'S LARGEST FLASH TYPE DESALTING PLANT AT TIJUANA, MEXICO,
For primary bibliographic entry see Field 03A.
W70-07765

EXIT GRADIENTS INTO SUBSURFACE DRAINS,
For primary bibliographic entry see Field 04A.
W70-07783

DESIGNING THE LININGS OF PRESSURE TUNNELS IN ANISOTROPIC ROCK,
V. S. Eristov.
Gidrotekhnicheskoe Stroitel'stvo, No 3, p 28-31, 1965. Transl from Russian by the Bureau of Reclamation, Trans 740, March 1970. 11 p, 3 fig, 4 ref.

Descriptors: *Tunnel linings, Anisotropy, Elastic theory, Elastic deformation, Stress, Displacements, *Structural analysis, Structural design, Tensile stress, *Foreign design practices, Rocks, *Pressure tunnels , Rock properties, *Radial stress, *Rock mechanics, Theoretical analysis, Tunnel design, Equations, *Deformation.
Identifiers: Radial loads, Rock pressures, USSR, Elastic coefficient, Formulas, Deformation restraint.

Formulas are derived for the stresses and radial deformation of a pressure tunnel lining in anisotropic rock using the theory of elasticity. The surrounding rock is assumed to be transformed into a monolithic elastic medium by grouting. Considering, with small error, only radial components of deformation and elastic resistance is possible. By using a constant coefficient of elastic resistance, the formulas are transformed into the formulas for an isotropic medium. The deformations obtained by these formulas for a thin lining coincide reasonably well with the corresponding deformations for an opening in an orthotropic medium loaded along the contour with a uniform radial load. A sample calculation is given. (USBR)
W70-07882

DESIGN OF TUNNEL SUPPORT SYSTEMS,
Illinois Univ., Urbana; and Mathews (A.A.), Inc., Arcadia, Calif.
U. D. Deere, R. B. Pack, and J. Monsees.
Paper, 49th Annual Meeting of the Highway Research Board, Washington, D.C. Jan 1970. 18 p, 1 fig, 4 tab, 10 ref.

Descriptors: *Tunnel design, *Supports, Tunnels, Excavation, Gunite, Economics, Deformation, Tunnel linings, Rock bolts, Stress-strain curves, Buckling, Disturbances, Tunneling, Tunnel construction.
Identifiers: *Tunnel supports, Rock breakage, Shotcrete, Illinois U.

Selection and design of the support system are 2 of many interrelated factors in the overall design of a serviceable and economical tunnel. The type of support, method of excavation, and character of the ground are inseparable considerations. Factors pertinent to good design of tunnel supports are: (1) types and functions of tunnel support systems; (2) types of primary support systems; (3) planning and design of tunnel support systems; (4) modern concepts of the design of tunnel support systems; (5) guidelines for selecting primary support systems for rock and soil tunnels; and (6) improvement in support systems for high-speed tunneling. Results of studies conducted at the University of Illinois on various aspects of design of support systems for transportation tunnels are described. (USBR)
W70-07890

BANK PROTECTION ON U.S. NAVIGABLE WATERWAYS,
Mississippi River Commission, Vicksburg. Channel Improvement Branch.
For primary bibliographic entry see Field 02J.
W70-07942

BANK PROTECTION OF THE MANCHESTER SHIP CANAL,
Manchester Ship Canal Co. (England).
A. E. Blyth.
Perma. Int. Asso. of Navigation Congr., XXIInd Int. Navigation Congr., Sect. 1, Subj. 6, Inland Navigation, p 157-167, Paris, 1969. 11 p, 1 map, 7 fig, 7 photo, 6 ref.

Descriptors: *Retaining walls, *Construction, Navigable waters.
Identifiers: *Manchester Canal.

The different types of revetment used along the Manchester Canal are described. The evolution in the design of these structures over the years is presented. The arrangements adopted depend on

local conditions. These arrangements must be able to cope with efforts as a result of the lowering of the water level and the return currents. The paper describes the methods used for maintaining the structures. These methods are based on experience rather than on theoretical considerations. The paper is written in English and contains a French summary. (Grossman-Rutgers)
W70-07943

SHIP-CANAL BANK PROTECTION,
Technische Hogeschool, Delft (Netherlands).
L. Van Bendegom, J. Bouwmeester, W. Bokhoven, P. Boer, and H. J. Span.
Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Sect 1, Subj 6, Inland Navigation, p 109-137, Paris, 1969. 29 p, 17 fig.

Descriptors: *Retaining walls, Construction materials, Costs, Navigable waters.

The protection of waterway banks must be considered as part of the general problem of the regulation of waterways at the lowest cost of construction and maintenance. Factors that influence the choice of revetment: level of water and its variations, position of the original water table and under pressures, eventual draining of the soil dimensions of the canal, dimensions and speeds of vessels and the importance of traffic. Several formulae are presented which permit the calculation of the thickness of the revetment and other important factors. Recent structures for bank protection are described. The article is written in English and includes a French summary. (Grossman-Rutgers)
W70-07944

PROTECTIVE REVETMENT OF RIVER EMBANKMENTS (IN FRENCH).
Giovanni Padoan, and Francesco Marzolo.
Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Sect 1, Subj, 6, Inland Navigation, p 77-85, Paris, 1969. 9 p.

Descriptors: *Retaining walls, *Concrete-lined canals, Bank erosion.
Identifiers: *Rugosity.

Canal revetments contribute to: conservation of the canal bed, to the impermeabilization of the canal bed, and to the reduction of bank rugosity. Efforts must be made to resist erosion due to the current and to the displacement of vessels; both factors increase with the speed of vessels and with propellor wash. It must be insured that the canal bed is waterproof if it traverses permeable ground and if the original water table is at a different level from that of the canal water. New revetments such as concrete cast in site, pre-fabricated slabs and bituminous revetments are now used in addition to former types of revetments. The article is written in French and contains an English summary. (Grossman-Rutgers)
W70-07945

PRINCIPLES GOVERNING THE DESIGN AND CONSTRUCTION OF ECONOMIC REVETMENTS FOR PROTECTING THE BANKS OF RIVERS AND CANALS FOR OCEAN - AND INLAND NAVIGATION,
Ingenieur general des Ponts et Chaussees, Paris (France).
For primary bibliographic entry see Field 06A.
W70-07946

ECONOMICS OF BANK PROTECTION ON CANALS AND NAVIGABLE RIVERS (IN FRENCH),
Service Technique de la Direction des Ports Maritimes et des Voies Navigables (France).
R Tenaud.
Perma Int Asso of Navigation Congr, XXIInd Int Navigation Congr, Sect 1, Subj 6, Inland Navigation, p 57-76, Paris, 1969. 20 p, 7 fig, 2 tab.

Descriptors: *Bank erosion, *Retaining walls, Navigable rivers, Concrete-lined canals, Navigation.
Identifiers: *Schyf formula.

The paper reviews the various factors which lead to the degradation of canal and navigable river banks. Tests carried out on scale models have shown that the amplitude of the first wave lifted at the front of the vessel is roughly double of the lowering indicated by the water level calculated by the Schyf formula. A review of the principal types of bank protection instituted in France is included. A few general rules on the use of various types of revetment are given. Protection against lapping can lead to more economical conclusions than a revetment over the entire height of the bank. The article is written in French and contains an English summary. (Grossman-Rutgers)
W70-07947

PARR V CITY OF ERLANGER (ASSESSMENTS FOR MUNICIPAL IMPROVEMENT BENEFITS).
For primary bibliographic entry see Field 06E.
W70-08017

COMMONWEALTH V DOUGHERTY (POLICY BEHIND LICENSING OF PLUMBERS).
For primary bibliographic entry see Field 05G.
W70-08063

TOWN OF PURCELLVILLE V POTTS (REASONABLE USE AND DIVERSION OF WATERS FROM A NATURAL STREAM).
For primary bibliographic entry see Field 04A.
W70-08064

8B. Hydraulics

FREE SURFACE, VELOCITY GRADIENT FLOW PAST HEMISPHERE,
Utah State Univ., Logan. Dept. of Hydraulic Engineering; Colorado State Univ., Fort Collins. Dept. of Civil Engineering; and North Dakota Univ., Grand Forks. Dept. of Civil Engineering.
Gordon H. Flammer, J. Paul Tullis, and Earl S. Mason.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7418, p 1485-1502, July 1970. 18 p, 10 fig, 1 tab, 10 ref, append. NSF Grant GP-2618.

Descriptors: *Open channel flow, *Flow around objects, *Flow resistance, Hydraulics, Nonuniform flow, Unsteady flow, Hydraulic models, Laboratory tests, Fluid friction, Shear drag, Viscosity, Free surfaces.
Identifiers: Flow past hemispheres.

The drag on a hemisphere in a finite-flow field with free surface effects is evaluated by successively studying six flow fields, which allows the study of one new variable at a time. These flow fields are: the semi-infinite uniform and nonuniform flow fields, the finite uniform and nonuniform flow fields without free surface effects, and the finite uniform and nonuniform flow fields with free surface effects. Three regimes of flow are defined for the hemisphere which are: (1) A regime of pronounced free surface effects, (2) a regime of moderate free surface effects, and (3) a regime of negligible free surface effects. The effect of these variables and range of conditions under which they are effective is considered. (Knapp-USGS)
W70-07657

DISTRIBUTION OF TRACTIVE FORCE IN OPEN CHANNELS,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
Viswanathan C. Kartha, and Hans J. Leutheusser.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7415, p 1469-1483, July 1970. 15 p, 7 fig, 3 tab, 12 ref, append. National Research Council of Canada Grant A-1541.

Descriptors: *Open channel flow, *Hydrauli design, *Turbulent flow, *Tractive forces, *Alluv al channels, Sediment transport, Scour, Erosion Laminar flow, Instrumentation, Hydraulic models.
Identifiers: Wall shear (Hydraulic).

The design of alluvial channels by the tractive forc method requires information on the distribution o wall shear stress over the wetted perimeter of th cross section. Study was undertaken to provid details on measured shear distributions to chec the validity of currently available design informa tion. The experiments were carried out in smooth-walled laboratory flume at various aspec ratios of the rectangular cross section. None of th present analytical techniques can be shown to pro vide precise details on tractive force distribution in turbulent channel flow. (Knapp-USGS)
W70-07658

COMPUTER DETERMINATION OF FLOW THROUGH BRIDGES,
Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.
Bill S. Eichert, and John Peters.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7412, p 1455-1468 July 1970. 14 p, 8 fig, 2 tab, 9 ref, append.

Descriptors: *Computer programs, *Flow measurement, *Bridges, Hydraulic models, Hydraulics Open channel flow, Stage-discharge relations.
Identifiers: *U.S. Army Corps of Engineers, *Flow through bridges.

Techniques used for the computer determination of water surface profiles through bridge structures of various shapes and sizes, including culverts under high fills, are presented. Theoretical aspects of procedures using momentum principles are described in detail for both supercritical and subcritical flow. Methods for determining the controlling type of flow (low flow, pressure flow, weir flow, or various combinations of these) and corresponding changes in water surface elevation, are described and illustrated. Stress is placed on the need for additional research and field data to evaluate the accuracy of various techniques that are suited to computer determination of water surface profiles through bridges. Limitations of the procedures are described. (Knapp-USGS)
W70-07659

EFFICIENCY OF AIR-ENTRAINING VORTEX FORMATION AT WATER INTAKE,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
Michael C. Quick.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY7, Paper 7399, p 1403-1416 July 1970. 14 p, 9 fig, 10 ref, append.

Descriptors: *Vortices, *Air entrainment, *Intakes, Bubbles, Hydraulics, Flow, Hydrodynamics Pumps, Open channel flow, Closed conduit flow Aeration, Mixing.
Identifiers: Air-entraining vortices.

The basic mechanisms for air-entraining vortices to form at a water intake are examined and vorticity arising in boundary layers is considered in detail. Theoretical expressions are developed for calculating the maximum strength of air-entraining vortex which may form at a water intake. Experiments confirm that it is possible to calculate the strength of vortex from a knowledge of approach conditions and intake geometry. For the conditions of these tests the efficiency of vortex formation is approximately unity. A kinetic energy evaluation for the approach flow and intake flow sections indicates the organizational nature of the process and gives values for the additional pressure losses at an intake which are attributable to vortex formation. (Knapp-USGS)
W70-07662

CEPTION AND ENTRAINMENT IN SELF-RATED FLOWS,
ian Inst. of Science, Bangalore. Dept. of Civil Hydraulic Engineering.
mmaiah Gangadharaiah, Nagar S. Lakshmana , and Kyathasandra Seetharamiah.
CE Proceedings, Journal of the Hydraulics Divi-, Vol 96, No HY7, Paper 7427, p 1549-1565, 1970. 17 p, 9 fig, 3 tab, 17 ref, append.

criptors: *Air entrainment, *Turbulent flow, eration, *Open channel flow, *Air-water inter-es, Free surfaces, Boundary layers, Hydraulics. ntifiers: Self-aerated flow.

eption and entrainment of air in self-aerated n channel flows are studied. For inception to ur surface eddies should leave the free surface the whole fluid should be turbulent. A criterion the surface eddy to leave the free surface is for-ated using the energy concept. A method to ate the zone of boundary layer emergence to the surface which causes the whole fluid to be tur-ent in the case of flow over free overfall spill-s is developed. Using the concept of entrain-nt the basic equations for aerated flow down matic channels are formulated. Using these ations, several flow characteristics of the form aerated flow are studied. The investiga-ns help in computing uniform aerated flow racteristics knowing the nonaerated flow data. (Knapp-USGS)
W70-07670

PERIMENT ON AN EFFLUENT DISCHARG-G FROM A SLOT INTO STATIONARY OR OW MOVING FLUID OF GREATER DENSI-

draulics Research Station, Wallingford (En-nd).
D. Anwar.
rnal of Hydraulic Research, Vol 7, No 4, p 411-, 1969. 21 p, 8 fig, 8 ref.

criptors: *Mixing, *Dispersion, *Jets, *Con-tion, Density currents, Turbulent flow, Hydrau-models, Laboratory tests, Instrumentation, Dif-on.
ntifiers: Convection plumes.

periments were conducted in which fresh water discharged upward from a slot into a stationary slow-moving ambient fluid, a solution of salt er of uniform density. The density at points in plume was determined by measuring the con-tration of the salt solution using an electrical ductivity probe. The profiles of density, within range of experimental error, were of Gaussian n, close to those of a natural convection plume. theory of a convection plume over a finite rce was applied to evaluate the measured data. measured data agreed reasonably well with the oretical results when the origin of the plume was he height of the potential core, which was about e times the nozzle-width. (Knapp-USGS)
0-07672

THODS SYSTEMIZATION MANUAL: EPARATION OF HYDROLOGIC ENGINEER-G COMPUTER PROGRAMS.
ps of Engineers, Sacramento, Calif. Hydrologic ineering Center.

drologic Engineering Center of the Corps of En-eers, U.S. Army, U.S. Army Engineer District, remento, Calif, Jan 1970. 18 p, 2 exhibits.

criptors: *Computer programs, *Hydrologic ects, *Engineering, *Efficiencies, Testing, cumentation, Hydrographs.
ntifiers: Generalized computer programs, HEC.

purpose of the manual was to provide sug-ions for systemizing hydrologic engineering puter programs and to report on some pro-mming ideas developed in HEC and at various ps offices. Guidelines were designed to increase ciency of computer usage and to promote easy exchange of program routines among hydrologic engineers. The term 'generalized computer program' was adopted by the HEC as being descriptive of a kind of program which 'has application to most or all problems in a particular area of technology'. Other important aspects of the problem described were: testing, documentation, maintenance of up-to-date source decks, program distribution and assistance to users application of the programs to both simple and complex problems. An example of a highly flexible generalized program, the HEC 1 - Flood Hydrograph Package was given as an exam-ple. (Kriss-Cornell)
W70-07853

VELOCITIES OF CULVERT JETS FOR INCIPIENT EROSION,
Geological Survey, Mineola, N.Y.; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W70-07912

INITIAL SCOUR AND SEDIMENT MOTION DUE TO AN IMPINGING SUBMERGED JET,
Technion - Israel Inst. of Tech., Haifa.
M. Poreh, and E. Hefez.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11 - 14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C2, p 9-16, 1967. 8 p, 10 fig, 6 ref.

Descriptors: *Scour, *Sediment transport, *Jets, Turbulent flow, Non-uniform flow, Streambeds, Shear stress, Particle size, Channels, Forecasting, Viscosity, Specific weight.
Identifiers: *Scour and sediment movement, Submerged jets.

Sediment motion and scour caused by submerged jets are difficult problems to solve by theoretical analysis. An experimental approach to study the initial sediment motion uses a circular jet that impinges normally on a flat erodible bed. The entrainment region can be analyzed using a modified form of Shield's equation for the critical shear stress. Shield's analysis is based on the assumption that the beginning of the sediment motion in a given bed is related to a particular value of the critical shear stress. The submerged specific weight of the sediment, kinematic viscosity of the fluid, and diameter of sediment particles are parameters used to define the critical shear stress. The depth of the initial scour hole was almost zero near the stagnation point and reached a maximum depth near the point of maximum shear stress. Scour is initially limited to the region where the shear stress is larger than the critical shear stress. This region of entrainment in open channels can be theoretically predicted and practical measures can be taken to protect this region. (Carstea-USGS)
W70-07913

DETERMINATION OF THE DEPTH OF SCOUR AROUND AN OBSTRUCTION IN AN ALLUVIAL CHANNEL,
Central Water and Power Research Station, Poona (India).
Z. S. Tarapore.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C3, p 17-25, 1967. 9 p, 2 fig, 4 photo, 10 ref.

Descriptors: *Scour, *Alluvial channels, *Sediment transport, *Flow around objects, *Model studies, Hydraulic models, Shear stress, Sediment yield, Flow, Sediment load, Bridges, Piers, River beds, Dams, Cofferdams, Sedimentation rates.
Identifiers: *Limiting scour concept, Local scour.

Local scour occurs when the sediment transporting capacity of water at a given point is greater than the sediment supply. This situation can occur when the sediment load is removed or when there is a local increase in shear stress, which can be caused by the presence of an obstacle in the flow. A theoretical method is given for prediction of scour around an obstruction, such as a bridge pier. The concept of limiting scour is introduced; this means the condition of the scour hole where no further erosion or deposition takes place at any point of the river bed. The following assumptions are made: (1) The theory considers the initial flow patterns in the vicinity of the obstruction; (2) The velocity diffuses into the scour hole once the scour hole develops; (3) The bed material in the section of maximum velocity rests at the angle of repose; and (4) The rate of sediment transportation between streamlines is a constant. The theoretical method was applied to determine the depth of scour around a cofferdam to be constructed for the Captain Anthony Meldahl lock and dam. There was a good agreement between calculated and observed values. (Carstea-USGS)
W70-07914

MEAN-VELOCITY CRITERION FOR SCOUR OF COARSE UNIFORM BED-MATERIAL,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 02J.
W70-07915

ON THE MECHANISM OF THE LOCAL SCOUR FROM FLOWS DOWNSTREAM OF AN OUTLET,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02J.
W70-07916

SCOUR IN STONE BEDS,
Saskatchewan Univ., Saskatoon. Dept. of Civil Engineering; and Crippen (G. E.) and Associate Ltd., Vancouver (British Columbia).
C. D. Smith, and D. K. Strang.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper 68, p 65-73, 1967. 10 p, 4 fig.

Descriptors: *Scour, *Streambeds, *Weirs, *Stilling basins, Jets, Head loss, Tailwater, Flumes, Simulation analysis, Arpons, Engineering structures, Cavitation.
Identifiers: Stilling basin scour.

The energy at the base of the weir is dissipated by building a concrete apron downstream. Scour hole development and the feasibility of criteria for stone stilling basins are discussed. If drag forces of the nappe impingement exceed the existing forces, the scour hole begins to form. The drag force decreases as the hole deepens and as the velocity at the bottom of the plunging jet is reduced. The scour profile becomes stabilized when equilibrium is reached. The scour depth is a function of water head, weir length, tailwater depth, and stone properties such as size, size distribution, shape, and specific gravity. The scour depth will increase if either water head or weir height increases or as tailwater or mean stone size decreases. Flume experiments were conducted to establish relationships between the variables. The data are presented in dimensionless plots. The proposed design for building stone stilling basins was verified under a simulated natural hydrology and was found satisfactory for field use. Stone stilling basins are recommended over concrete basins because they are more economical and do not require highly skilled labor. (Carstea-USGS)
W70-07917

NOTE ON THE METHODS OF STUDY OF THE LOCAL SCOUR OF BED ROCKS ON A REDUCED MODEL,
For primary bibliographic entry see Field 02J.

W70-07918

THE GEOMETRICAL DEVELOPMENT AND DEVELOPMENT IN TIME OF SCOUR BENEATH A THIN SLAB,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 02J.
W70-07919

CONSIDERATIONS CONCERNING SCOUR IN THE CASE OF FLOW UNDER GATES,
Technische Hochschule, Munich (West Germany).
F. Valentin.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C11, p 92-96, 1967. 5 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Scour, *Gates, *Sediment transport, Engineering structures, Gate control, Particle size, Dimensional analysis, Uniform flow.

Experimental work was conducted to study the scour behind a gate by using uniform flow in experiments conducted for 370 hours. The maximum depth of scour was treated according to the law of similarity. The most effective diameter of the grain used was between 0.73 and 13.5 mm. Dimensional analysis showed a good agreement between experimental data and theoretical considerations. (Carstea-USGS)
W70-07920

ON SCOUR AROUND SPUR-DIKE,
Nihon Univ., Tokyo.
For primary bibliographic entry see Field 02J.
W70-07921

SCOUR BELOW SUBMERGED SOLID BUCKET-TYPE ENERGY DISSIPATORS,
Mysore Engineering Research Station, Krishnarajasagara (India).
D. Doddiah.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C13, p 105-116, 1967. 12 p, 11 fig, 1 tab, 7 ref.

Descriptors: *Scour, *Energy dissipation, *Stilling basins, *Roller gates, Engineering structures, Model studies, Flumes, Hydraulic models, Sediment transport.
Identifiers: *Submerged bucket-type energy dissipator, Scour zones, Solid roller.

The occurrence of scour below solid roller or submerged bucket energy dissipators is discussed. The submerged solid bucket is an effective energy dissipator but it requires very deep tailwater for good performance. It can be considered as a shorter stilling basin with a greater depth. The depth of scour decreases and the distance from the toe of the structure of maximum scour increases with an increase in the tailwater depth. A decrease in the radius increases scour. It appears to be no appreciable change as far as the flip action is considered. Zones of zero scour and flip action have been delineated. (Carstea-USGS)
W70-07922

SCOURS BEHIND STILLING BASINS WITH ENDSILLS OF BAFFLE-PIERS,
Technische Hochschule, Brunswick (West Germany).
Friedrich Zimmermann, and Ulrich Maniak.
French summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C14, p 117-124, 1967. 8 p, 5 fig, 4 ref.

Descriptors: *Stilling basins, *Scour, *Baffles, *Piers, *Sediment transport, Energy dissipation, Streams, Waterfalls, River beds, Model studies, Hydraulic models, Hydraulic jump, Roller gates, Control structures, Stream erosion.
Identifiers: Endsills, Baffle piers.

The rate of energy dissipation in stilling basins can be judged from the nature of scour in the movable bed of a river downstream from a stilling basin or a weir. Generally, weirs with small or medium waterfall do not require any bed protection. Large size scours should be prevented at stilling basins below weirs because they may endanger structural stability. Model tests were conducted using 8 types of endsills of baffle piers in order to determine their effect upon the movable river bed behind them. The results were compared with those obtained from a flat stilling basin without any energy dissipators. The dimension of scour was reduced by more than 50% by the baffle piers. The baffle piers contributed to the stable position of the surface roller within the stilling basin. The results of the model studies are confirmed by observations. (Carstea-USGS)
W70-07923

AN INTERESTING HYDRAULIC EFFECT OCCURRING AT LOCAL SCOUR,
Hydraulic Research Inst., Prague (Czechoslovakia).
Zdenek Thomas.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C15, p 125-134, 1967. 10 p, 10 fig.

Descriptors: *Scour, *Piers, *River beds, *Sediment transport, Flow around objects, Hydraulic properties, Slabs, Flow control, Erosion control.
Identifiers: *Scour at piers.

Experiments were conducted to study the effect of a horizontal shield upon the scour phenomenon at piers. The purpose of the shield was to prevent the vertical flow from reaching the river bed. A circular cylinder pier with a ring-shaped horizontal shield was used. Tests were conducted by using two shields placed at different heights above the bottom. The experimental results are expressed in dimensionless coordinates. The scour depth decreased considerably when the shield was used. Empirical equations relating the scour and the height of the shield above the bottom are given. The depth and the size of a scour can be considerably decreased by placing a thin horizontal slab near the bottom of piers. (Carstea-USGS)
W70-07924

EROSION EXPERIENCE DOWNSTREAM OF BED STABILIZATION AND WATER LEVEL CONTROL STRUCTURES,
Corps of Engineers, Omaha, Nebr.
Walter M. Linder.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C16, p 135-142, 1967. 8 p, 6 fig, 1 ref.

Descriptors: *Stream erosion, *Missouri River, *Control structures, *Scour, *Bank stabilization, Water levels, Tributaries, Meanders, Channels, Flood control, Levees, Drawdown, Model studies, Bank erosion, Alluvial channels, Erosion control.
Identifiers: *Rock sills, Bed stabilization.

Tributaries to the Missouri River meandered and scoured deep channels near their mouths in order to reduce the excessive gradient near the confluence. Construction of flood control works has provided enlarged and straightened channels and levees control the water surface elevation of high flows. Without some form of water level control a severe drawdown condition and high velocities would result in bed and bank erosion. Model tests were performed by using structures which consisted of rock sills at the mouth of the Little Sioux. The rock sills are flexible and can adjust to significant degrees of erosion that could ordinarily damage or destroy a conventional concrete structure. The rock sills should not be used as a critical depth control except for very low flows. They should be designed to operate under submerged conditions. Hydraulic model tests are important but only three-dimensional models can fully reveal the major sources of difficulty. A carefully designed and constructed rock structure can effectively control water level and prevent channel erosion. (Carstea-USGS)
W70-07925

EVOLUTION OF SCOUR DOWNSTREAM FROM A MOBILE BARRAGE RESTING ON INCOHERENT MATERIAL, AND SOME CONSIDERATIONS OF THE SCOUR MECHANISM,
State Hydraulic Works, Ankara (Turkey). Dept. of Research.
Turhan Acatay.
English summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C17, p 143-150, 1967. 8 p, 5 fig, 2 tab.

Descriptors: *Scour, *Streambeds, *Hydraulic structures, *Gates, Dams, Flow, Sediment load, Slopes, Dredging, Climatic data, Sediment transport, Agricultural watersheds, Hydraulic gates, Sedimentation, Deposition (Sediments).
Identifiers: *Scour near dams.

Local scour at Boceli small dam was investigated. The gates were closed and opened in three different ways and the effects on local scour were measured. A rapid occurrence of local scour was observed in the region with a strong flow and a high velocity. Sediment load increased considerably due to agricultural use of the upper areas with steep slopes. As a result, the bottom around the dam rose 1.70 m. About 3500 cu m were dredged from an area of 50 sq m in order to bring the bottom to the normal level. The changes in climate conditions and other natural factors in the watershed are important in designing the hydraulic works. (Carstea-USGS)
W70-07926

ANALYTICAL STUDIES ON THE EFFECT OF FRICTION AND COHESION ON FLOTATION GRADIENTS,
Punjab Univ., Chandigarh (India).
S. K. Sharma.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C19, p 162-168, 1967. 7 p, 3 fig, 4 ref.

Descriptors: *Stream erosion, *Porous media, *Underseepage, *Weirs, Friction, Cohesion, Flotation, Design criteria, Slopes, Streambeds, Seepage, Model studies, Tension, Gravity, Sediment transport.
Identifiers: *Flotation gradients.

The two major assumptions made during the design of weirs on permeable foundations are: (1) The downstream bed is horizontal and (2) the porous material of the bed is devoid of friction and cohesion. However, these assumptions do not hold in nature. The criteria for testing the stability of sloping beds subject to seepage were considered for noncohesive and cohesive bed materials. The generalized equations for exit of critical gradients and factor of safety were derived from model studies. In the case of noncohesive material, a particle will be lifted up when the seepage force exceeds a value just sufficient to balance the submerged weight. In the case of cohesive material, the soil

rticle will be lifted up when the seepage forces ting upward normal to the soil slope exceed the m of the gravitational and tension forces acting rmal to the slope in the downward direction. arstea-USGS)
70-07927

ECHANISM AND COMPUTATION OF OCAL AND GENERAL SCOUR IN NON-OHESIVE, COHESIVE SOILS AND ROCK EDS,
r primary bibliographic entry see Field 02J.
70-07928

THEORETICAL AND EXPERIMENTAL UDY OF DRAG AND LIFT FORCES ACTING N A SPHERE RESTING ON A HYPOTHETI-AL STREAMBED,
ricultural Research Service, Oxford, Miss. Sedi-ntation Lab.
r primary bibliographic entry see Field 02J.
70-07930

OCAL SCOUR AROUND A CIRCULAR YLINDER,
obe Univ. (Japan). Dept. of Civil Engineering.
igeru Tanaka, and Motoaki Yano.
ench resume included. Proceedings 12th Con-ess of the International Association for Hydraulic esearch, Sept 11-14, 1967, Colorado State Univ, rt Collins, Vol 3 (Erosion and local scour wnstream from hydraulic structures), Paper 3, p 193-201, 1967. 9 p, 5 fig.

escriptors: *Scour, *Flow around objects, *Sedi-nt transport, Open channel flow, Vortices, reams, Flumes, Drill holes, Engineering struc-es, Flow, Channel flow, Hydraulic design, Model dies, Hydraulic models.
entifiers: *Streambed erosion, Scour around a linder.

laboratory study of local scour around a circular linder placed in open channel flow indicated that al bed materials were transported by vortex flow curring at the front foot of the cylinder. The vor-x is generated by a combination of main flow at e upper stream portion of the cylinder and poten-l flow in the downward direction along the front rface of the cylinder. The size of the local scour is ated to strength and size of the vortex flow. The rtex flow could be controlled by hydraulic ethods such as holes drilled through the cylinder putting an interceptor around the cylinder sur-ce. The size and position of the hole or intercep-r were determined mainly by flume experiments. ch methods could also be applied to prevention local scour at the front bed of vertical walls in en channel flow. (Carstea-USGS)
70-07931

PPLICATION OF THE WALL JET THEORY O EROSION AT THE OUTLET OF HYDRAU-C STRUCTURES,
rps of Engineers, Mariemont, Ohio; and Cincin-ti Univ., Ohio. Dept. of Civil Engineering.
szlo Varga, and Louis M. Laushey.
ench resume included. Proceedings 12th Con-ess of the International Association for Hydraulic esearch, Sept 11-14, 1967, Colorado State Univ, rt Collins, Vol 3 (Erosion and local scour wnstream from hydraulic structures), Paper 4, p 202-206, 1967. 5 p, 2 fig, 4 ref.

escriptors: *Stream erosion, *Scour, *Hydraulic uctures, *Jets, *Outlet works, Aprons, Culverts, ear stress, Boundary layers, Pipe flow, Open annel flow, Tailwater, Streambeds, Model stu-es, Hydraulic models.
entifiers: *Wall jet theory, Submerged culverts.

osion at the outlet of submerged culverts was stu-ed experimentally and theoretically. Shear esses at the inception of erosion were deter-ned by using secondary layer theory for wall jets, based on critical pipe velocities which initiated erosion. The critical tractive stress concept of open channel flow was found applicable to submerged jets. If the tailwater covers the top of the outlet pipe, the magnitudes of the critical exit velocity and the critical bed shearing stress are independent of the amount of submergence over the top of the outlet. The boundary layer theory can be used to predict the shearing stress along the bed and the length of protective aprons that might be required. (Carstea-USGS)
W70-07932

ON THE FLOW CHARACTERISTICS OF VORTICES IN THREE-DIMENSIONAL LOCAL SCOUR,
Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 02J.
W70-07933

THE EFFECT OF ENTRAINED AIR ON THE SCOURING CAPACITY OF WATER JETS,
Societe Grenobloise d'Etude et d'Applications Hydrauliques (France).
For primary bibliographic entry see Field 02J.
W70-07934

THE SCOURING ENERGY OF THE MACROTURBULENT FLOW DOWNSTREAM OF A HYDRAULIC JUMP,
Technische Hochschule, Munich (West Germany). Hydraulics Research Station, Obenach.
Fritz Hartung, and Klausotto Csallner.
French summary included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C27, p 227-237, 1967. 11 p, 4 fig, 2 ref.

Descriptors: *Scour, *Turbulence, *Flow, *Hydraulic jump, Flow around objects, Streams, Model studies, Tractive forces, Hydraulic models, Hydraulic structures, Energy dissipation, Froude number.
Identifiers: Macroturbulent flow, *Scouring energy.

In order to obtain estimates of the range of magnitude and the distribution of the neglected macroturbulent energy in hydraulic jumps it was necessary to conduct model tests. In these tests the turbulence energy was observed indirectly by its effects on tractive force and scouring. Its order of magnitude was obtained theoretically by applying the Meyer-Peter formula for the beginning of tractive force action. Relative energy dissipation is a function of the Froude number. The energy dissipation due to the hydraulic jump is considerably smaller than estimated by means of the conventional two-dimensional analysis. The remaining surplus energy head decreases downstream of the hydraulic jump according to an exponential function. (Carstea-USGS)
W70-07935

SOME HYDRAULIC CHARACTERISTICS OF TRAPEZOIDAL DROP STRUCTURES,
Alabama Univ., Huntsville. Dept. of Fluid Mechanics; and Federal Power Commission, Washington, D.C.
Cornelius C. Shih, and Donald F. Parsons.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C29, p 249-259, 1967. 11 p, 10 fig, 9 ref.

Descriptors: *Hydraulic properties, *Drops (Structures), *Weirs, Flow, Steady flow, Discharge (Water), Dimensional analysis, Channel morphology, Streambeds, Model studies, Hydraulic models, Vortices, Turbulence.
Identifiers: *Trapezoidal drop structures.

This study is concerned with some of the hydraulic characteristics of flow over drop structures connecting two trapezoidal channels at different elevations. The drop structures are formed by an abrupt drop in the horizontal channel bottom, and are equipped with or without a weir. The relationships among the quantities pertinent to the hydraulic characteristics are investigated through dimensional and experimental analyses. The dimensional analysis which was based on theoretical consideration of the flow problem, resulted in a set of dimensionless parameters, namely the relative depth, the drop number, and geometric parameters of the drop structure. Experimental results are presented in graphical form through dimensionless parameters for various trapezoidal drop structures. Some typical flow phenomena are shown in photographs. (Carstea-USGS)
W70-07936

TIME SCALE OF TWO-DIMENSIONAL LOCAL SCOUR,
Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 02J.
W70-07937

INFLUENCE OF TIME AND HYDROGRAPH OF FLOODWATER ON THE EROSION OF ARTIFICIALLY CONTRACTED STREAM BEDS,
G. V. Zheleznyakov, L. G. Begam, and V. S. Altunin.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C33, p 283-291, 1967. 9 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Stream erosion, *Hydrographs, *Floods, *Streambeds, Hydraulic models, Steady flow, Unsteady flow, Cohesionless soils, Streams, Velocity, Backwater, Runoff, Discharge (Water).
Identifiers: *Artificial streambeds, Constricted flow, Lopasnya River, USSR.

The erosion of artificial streambeds was studied in hydraulic models under uniform and nonuniform flow conditions. The deformation occurring in a noncohesive bed material under steady flow was compared with that obtained with unsteady flow and with constricted streambed. Experiments in natural conditions were conducted on the small Lopasnya River near Moscow. As a result of stream constriction, the velocities became redistributed in depth and width. At the beginning of the experiments, there was a visible leveling off of longitudinal velocities along a vertical line. The relationships between the backwater before the flow constriction and the form of floodwater hydrograph are given. It was concluded that in order to compute the deformation of a constricted channel, the maximum floodwater discharge, shape of the hydrograph, duration of floodwater and the volume of the runoff should be known. (Carstea-USGS)
W70-07938

EFFECT OF FLOOD HYDROGRAPHS ON THE REGIME OF ALLUVIAL AND BOULDER STAGE RIVERS ABOVE AND BELOW CONTROL STRUCTURES,
Uttar Pradesh Irrigation Research Inst., Roorkee (India).
O. P. Gupta, S. N. Gupta, and P. N. Saxena.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C34, p 292-302, 1967. 11 p, 10 fig, 1 ref.

Descriptors: *Scour, *Control structures, *Alluvial channels, *Floods, Hydrographs, Streams, Weirs, Boulders, Particle size, Slope stability, Energy dissipation, Streambeds, Stream erosion, Sediment transport, Channel morphology.
Identifiers: India, Ganga River.

Over one hundred years of data are presented to depict regimes of the boulder stage of the Ganga River and of the alluvial Ratmau torrent, India. A weir across the Ganga River reduced the upstream bed slope of the river from 10 ft/mile to 8 ft/mile, while the downstream slope remained unaffected for 45 years of operation. In the Ratmau torrent, the upstream slope of 8.23 ft/mile remained unchanged during 120 years of operation of the escape regulator while the downstream bed was lowered by 25 ft immediately below the control, and slope flattened to 4.15 ft/mile. A dentated sill at the downstream floor of the undersluices on the Ganga was not only effective in controlling bed scour but withstood the onslaught of moving boulders 30 cm and greater diameter. Energy dissipators at the downstream floor of the escape regulator at Ratmau controlled the bed scour immediately below it but retrogression continues in the entire 9 1/4 miles length of the torrent. (Carstea-USGS)
W70-07939

COMPUTATIONS ON NON-STEADY BEDLOAD-TRANSPORT BY A PSEUDO-VISCOSITY METHOD,
Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 02J.
W70-07940

RIVER BED SCOUR AT BRIDGE CONSTRICTIONS,
Central Water and Power Research Station, Poona (India).
C. V. Gole, and S. V. Chitale.
French resume included. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C38, p 330-337, 1967. 8 p, 5 fig, 7 ref.

Descriptors: *Scour, *Bridges, *Floods, *Engineering structures, Hydrographs, Hydrograph analysis, Rivers, Structural stability, Safety, Streambeds, Sediment transport.
Identifiers: *Scour at bridges, Constrictions.

Measurements of bed scour were made at Mokameh bridge on the Ganga River and on the Luni River at Samdari in Rajasthan, India. The rates of bed scour at these bridges were considered in relation to the flood hydrographs of the rivers. In the case of flash floods, the rate of water level rise is fast, and is not sufficient to produce scour at the bridge constriction. For structure safety on flashy rivers, the constriction should be designed to allow more waterway than is normally provided in rivers carrying sustained floods. In the case of rivers with gradual rise and fall of water (Ganga River), constrictions could be narrower because the reduction in width is compensated by an increase in depth due to bed scour. In contrast to the flashy river, the limiting depth of scour in rivers with gradual rise of water is reached by the time of the peak floods. (Carstea-USGS)
W70-07941

THE STUDY OF THE SCOURS BEHIND A SPILLWAY, (IN FRENCH),
Jose Colaric, E. Pichon, and Fabien Sananes.
Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 3 (Erosion and local scour downstream from hydraulic structures), Paper C37, p 322-329, 1967. 8 p, 7 fig.

Descriptors: *Scour, *Spillways, *Sediment transport, *Hydraulic models, Model studies, Specific weight, Particle size, Flow, Hydraulic properties, Sands, Stream erosion, Streambeds, Pressure drag, Velocity, Engineering structures.
Identifiers: *Erosion processes, Streambed scour, Sill.

The principal results of a joint research program at the Hydraulic Laboratory of Ljubljana, Yugoslavia, and the Laboratory of I.M.F.T., Toulouse, France, are summarized. The relations between hydraulic parameters such as depth of the scour, flow, chute, length and height of the flat sill, diameter and specific weight of the sand were studied at Ljubljana. At Toulouse many experiments were conducted on the scouring processes. The critical velocity of the grains dragging on the mobile bed and the pressure fluctuations were shown to be important in scouring processes. (Carstea-USGS)
W70-08095

8C. Hydraulic Machinery

STREAMFLOW FORECASTING, A VITAL ELEMENT IN WATER MANAGEMENT,
Bureau of Reclamation, Salt Lake City, Utah.
For primary bibliographic entry see Field 07B.
W70-07677

DESIGN AND OPERATION OF THE FIRST DIGESTER GAS TURBINE IN THE U.S.A.,
Carollo (John) Engineers, Lafayette, Calif.
For primary bibliographic entry see Field 05D.
W70-07813

AIR ADMISSION AND FLOW AERATION IN HYDROTURBINES,
N. K. Barkov.
Elektricheskie Stantsii, No 8, p 26-29, 1968. Transl from Russian by Bureau of Reclamation, Trans No 635, Mar 1970. 17 p, 6 fig, 12 ref.

Descriptors: Foreign research, Hydraulic machinery, Surges, *Aeration, Turbine runners, *Air, Francis turbines, Kaplan turbines, Abrasion, Flow separation, Water hammer, Cavitation, Vacuum, Velocity distribution, Vibrations, *Compressed air, Fluid flow, Guide vanes, Draft tubes, Flow control, Erosion, Hydraulic design, *Hydraulic turbines, Bubbles.
Identifiers: USSR, Krasnoiarsk Powerplant USSR, *Cavitation control, *Air admission, Flow patterns, Turbine efficiency.

Various methods of atmospheric and compressed air admission in hydraulic turbines are described. Presently, atmospheric air is used successfully in hydraulic turbines for (1) filling the breaks in flow continuity, (2) preventing erratic conditions and dangerous vibration during periods of abnormal flow whirling in the draft tube, and (3) stabilizing flow for partial loading and off-design head operation. Compressed air injection is accomplished by several techniques and practical devices. Compressed air is used to reduce erosibe wear in hydraulic turbines caused by cavitation. Research shows that air in flow cavities lowers significantly the rate of cavitation damage and is highly effective in controlling pressure surging beyond the turbine runner. Futher study of air injection is required to improve the reliability and operation of contemporary hydromachines. (USBR)
W70-07880

THE RESISTIVITY OF INSULATING OIL IN A DIRECT-VOLTAGE FIELD,
Brown, Boveri and Co. Ltd., Baden (Switzerland).
B. Ganger, and G. Maier.
Brown Boveri Review, Vol 56, No 10, p 525-533, Oct 1969. 9 p, Fig, 9 ref, append.

Descriptors: *Transformer oils, *Resistivity, *Direct current, Extra high voltage, Electric potential, Transmission (Electrical), Electrons, Conductivity, Electric insulation, *Dielectrics, Resistance, Laboratory tests, Temperature, Electric fields, Impurities.
Identifiers: *Insulating oil, Space charge, Test results, Switzerland, Foreign testing.

Insulating oil and oil-impregnated paper in various forms are the principal materials for insulating equipment found in the rectifier and inverter stations of hydro transmission systems. Depending on function and location, insulation is subjected either to a straightforward d-c voltage, or to a combination of d-c voltage and a complex a-c voltage. With an electrical series arrangement consisting of one or more layers of solid insulating materials with oil-filled gaps in between, the partial voltage applied to each dielectric, in the case of d-c voltage, is solely dependent on the d-c conductances of individual materials. This conductance is defined as the ratio of leakage current to applied partial voltage. The current may also include proportions of a strongly time-dependent absorption current. Voltage distribution depends on the properties of the insulating materials used. Resistivity of new and aged transformer oil in relation to field strength was investigated almost to breakdown while varying the temperature, duration of the stress, and flow velocity. Conductivity of aged oil follows simple laws, owing to higher ion concentration, but certain anomalies are found with new oil, such as a maximum resistivity of 1 to 2 kv/mm, which can probably be attributed to space charge effects. (USBR)
W70-07881

SUPERCRITICAL BOILER UNITS, NOW IN THEIR THIRD GENERATION, GAIN TIGHTER GRIP,
Association of Electrical Engineers of the Montefiore Inst., Liege (Belgium).
Rene J. Bender.
Power, Vol 114, No 5, p 30-32, May 1970. 4 fig, 1 tab.

Descriptors: *Economic prediction, *Water pressure, Boilers, Boiler feed water, Efficiencies, Coals, Thermal pollution.
Identifiers: *Supercritical pressure, Subcritical pressure, Heat rate.

A review was made of the supercritical pressure situation to date. The first supercritical pressure boiler was built 14 years ago. Now, there are over 140 supercritical pressure units either operating, under construction, or on order in the U.S., Japan and Europe. The savings on these units go hand in hand with their efficiency. They will depend on the amount of fuel burned per year, the load factor, and the cost of fuel. Operating figures showed that the average overall heat rate for a 2400-psig plant is estimated at 9000 Btu/kWh, compared to 8860 Btu/kWh for a 3500-psig plant. This is a saving of 140 Btu/kWh or 1.6%. Further, when fuel costs are high, a supercritical operation is more economical. When fuel costs are low, a subcritical operation is more economical. The past headaches of supercritical pressure units included: (1) fouling of superheater and reheater elements; (2) leaks in the feedwater heaters; (3) starting valve leaks; (4) starting procedure; and (5) treatment of the feedwater. These problems have mostly been solved. Supercritical boiler units promise to be an important tool of the future. (Osborne-Vanderbilt)
W70-08120

THERMAL EFFECTS: A REPORT ON UTILITY ACTION,
For primary bibliographic entry see Field 05C.
W70-08122

NUCLEAR POWER AND THERMAL POLLUTION: ZION, ILLINOIS,
Argonne National Lab., Ill. Radiological Physics Div.
For primary bibliographic entry see Field 05C.
W70-08130

COOLING RESERVOIR STUDY,
For primary bibliographic entry see Field 05C.
W70-08132

D. Soil Mechanics

E OF EXPLOSIVE METHODS TO COMPACT IL DURING CONSTRUCTION OF IRRIGA-ON CANALS,
A. Vovk, G. I. Chernyi, and B. G. Kravets.
Irotekhnika i Melioratsiya, No 7, p 82-87, 1969.

scriptors: Foreign research, *Explosions, Explo-es, Canal seepage, Soil mechanics, *Soil com-tion, *Irrigation canals, Loess, Test holes, nesive soils, Moisture content, Seepage losses, ined canals, *Canal construction, Methodolo- Ponding tests, Test pits, Construction, Cost nparisons, Soil density, Testing Permeability.
ntifiers: USSR, Explosive excavation, *Con-ction methods, Rapid excavation, *Explosive struction, *Seepage control.

eral Ukrainian institutes conducted tests on g explosions for compacting soils to control page. A new method was developed using izontal cylindrical charges instead of concen-ed vertical charges. The method provided ater depth of compaction, less development of cracks around the crater, and a truer cross sec-n, reducing finishing work. The method was ed in clayey loams and loessial soils under con-ons similar to those encountered in building als in the Ukraine. Seepage was measured for 2 nths and again after one year by refilling craters y and allowing for evaporation losses. Density moisture content were measured by neutron gamma-gamma counting in special test holes. nstruction of irrigation canals in cohesive soils explosive methods is technically and economi-y sound; compaction is attained 2 to 3 m ond the canal perimeter. Construction time and of earth-moving equipment can be reduced atly. The new explosive construction technology reduce seepage by 12 to 14 times; conventional losive methods will reduce seepage by 4 to 6 es. (USBR)
0-07883

TION OF HORIZONTAL TO VERTICAL RESSES FOR GRAVELS,
eau of Reclamation, Denver, Colo.
lard Ellis, and R.R. Ledzian.
port, 7th International Conference of Soil chanics and Foundation Engineering, Mexico , Mexico, p 69-77, Aug 1969. 9 p, 2 fig, 2 tab, 6

scriptors: *Gravels, Stress, *Poisson ratio, rth pressure, Soils, Soil engineering, Soil chanics, Soil properties, Strain, Axial strain, Soil s, Lateral forces, Vertical loads, Settlement uctural), Laboratory tests, Effective stress.
ntifiers: *Deformation modulus, *At rest pres-e, Soil modulus, Triaxial tests, Triaxial test mber.

ratio of horizontal to vertical stresses in all s is a subject of increasing interest in soil chanics because of the parameters needed to the new methods of analysis, particularly the te element procedures. The parameters needed Poisson's ratio and modulus of deformation. A hod of studying the ratio is to perform triaxial s holding lateral strain to zero; as the vertical ss is increased, any tendency for lateral defor-ion is resisted by an increase in chamber pres-e. The procedure is referred to as a K sub o test, ub o being the notation for coefficient of earth ssure at rest. Two gravels with a maximum parti-size of 3 in. were studied. Gravel A was poorly ded and free draining, and Gravel B contained siderable silty and clayey fines and was relative-mpervious. Each gravel was tested at 2 gravel tents, 50 and 65%. The specimen size for all s was 6 in. in diameter by 15 in. high. The tests e conducted under chamber pressures varying n zero to 1000 psi. The K sub o values for both vels and gravel contents were in the range of 0.2 .4. The values of Poisson's ratio were the same all tests, ranging from about 0.15 to 0.30. The ues of modulus of deformation increased with easing effective stresses. (USBR)
W70-07885

OBSERVATIONS ON PORE PRESSURES BENEATH THE ASH LAGOON EMBANKMENTS AT FIDDLER'S FERRY POWER STATION,
Alberta Univ., Edmonton.
Z. A. Al-Dhahir, M. F. Kennard, and N. R. Morgenstern.
Paper 20, Conference on In-situ Investigations of Soils and Rocks, Institute of Civil Engineers, p 175-186, May 1969. 12 p, 10 fig, 1 tab, 11 ref.

Descriptors: *Pore pressure, Pore water pressures, *Embankments, Soil consolidation tests, *Earth dams, *Consolidation, Coefficients, Field tests, *Permeability, Dam foundations, Soil engineering, Soil mechanics, Piezometers, Instrumentation, Foreign research, Soil tests, Laboratory tests, Soil properties, Displacements, Settlement (Structural).
Identifiers: Embedded instruments, Permeability coefficients, Great Britain, Permeability tests, *In situ tests, Dam stability.

Fiddler's Ferry Power Station in Great Britain involved the construction of ash disposal lagoons, formed by 35-ft-high embankments, 13,500 ft long, on marsh ground adjacent to the River Mersey. The foundation for the embankments consisted of soft clay overlying peat and sand and was instrumented with piezometers. Results of observations over 5 yr are given. In situ constant heat tests were performed on 3 separate occasions at the site to obrain coefficients of consolidation and permeability and their variation with changes in effective stress. Laboratory tests underestimate the coefficients found from the tests and from the field dissipation records. Reasons for the discrepancies are given. Instability associated with a sudden rise in pore pressure was observed and is discussed. (USBR)
W70-07886

8E. Rock Mechanics and Geology

SHEAR AND SLIDING RESISTANCE TESTS OF ROCK JOINTS FOR FOREBAY DAM-GRAND COULEE THIRD POWERPLANT PROJECT,
Bureau of Reclamation, Denver, Colo.
M. L. Haverland, and G. L. Butler.
Bureau of Reclamation Report REC-OCE-70-6, Jan 1970. 28 p, 28 fig, 4 tab.

Descriptors: *Rock foundations, Strength, *Shear strength, Laboratory tests, Field tests, Grand Coulee Dam, Faults (Geology), Test procedures, *Shear tests, Rock mechanics, Foundation investigations, Granites, *Shear reistance, Cohesion, Friction, *Joints (Geology).
Identifiers: Sliding friction, *Sliding resistance, *Sliding tests, In situ tests, Rock tests, Grand Coulee Powerplant, Wash.

Shear and sliding resistance tests were conducted in the Bureau of Reclamation laboratory and at Grand Coulee Dam, Wash, on 15- by 15- by 8-in. rock blocks to determine the apparent cohesion and sliding resistance of rock joints in the area of the Forebay Dam for the Third Power-plant. Laboratory tests utilized the 5-million-pound testing machine for the normal load and a 200-ton ram for the sliding (shearing) load. The in situ tests used a cable tensioned by a 60-ton ram for a normal load and another 60-ton ram for the sliding load. Movements were measured using displacement transducers and were recorded continuously on X-Y recorders. (USBR)
W70-07870

NON-LINEAR STRESS-STRAIN RELATIONS FOR A HOMEGENEOUS SANDSTONE,
Imperial Coll. of Science and Technology, London (England).
N. R. Morgenstern, and A. L. Tamuly Phukan.
International Journal of Rock Mechanics and Mining Science, Vol 6, p 127-142, 1969. 16 p, 16 fig, 15 ref.

Descriptors: *Sandstones, *Stress-strain curves, Triaxial compression, Mechanical properties, Deformation, Bibliographies, *Rock properties, *Rock mechanics, Strength of materials, Elasticity (Mechanical), Elastic theory, Rock foundations, *Cpmpressibility, Compression curves, Strain, Porosity, Compressive strength.
Identifiers: Triaxial tests, Foreign testing, Great Britain, Rock tests, Bulk modulus, Hysteresis loops, *Rigidity modulus.

Triaxial compression tests on a homogeneous sandstone showed nonlinear deformation, hysteresis on cyclic loading, and an irrecoverable strain on complete unloading. These properties were increased by an increase in porosity and by wetting. The sandstone has a porosity ranging from 10.0 to 16.6%. The triaxial tests were performed at confining pressures of 0, 150, and 500 psi. The nonlinearity of compressibility was greater than that of the modulus of rigidity. For specimens of a given porosity, the variation of compressibility with the sum of principal stresses was independent of loading path. Compressibility changes linearly with the logarithm of the sum of principal stresses until the value for the compressibility of quartz is reached; compressibility then remains constant. This point is reached at a unique value and is independent of porosity. At this stress level, compressibility of the sandstone is the same as quartz but the modulus of rigidity is only about one-tenth that of quartz. The simplest stress-strain relationship for describing the behavior of sandstone is one in which the modulus of rigidity remains constant, and only the modulus of compressibility varies with the average principal stress. (USBR)
W70-07888

THE NUMBER OF TEST-PIECES REQUIRED TO DETERMINE THE STRENGTH OF ROCK,
Tokyo Univ. (Japan).
U. Yamaguchi.
International Journal of Rock Mechanics and Mining Science, Vol 7, No 2, p 209-227, Mar 1970. 19 p, 26 fig, 5 tab, 3 ref, append.

Descriptors: *Rock properties, *Rock mechanics, Rocks, Mechanical properties, *Compressive strength, *Tensile strength, Statistical analysis, *Statistical methods, Statistics, Samples, *Sampling, Splitting tensile strength, *Test specimens, Test procedures.
Identifiers: Foreign testing, Japan, *Rock tests, Test results.

Investigators studying the mechanical properties of rock often find a wide scattering of values in the measurement of rock strength. Statistical procedures are useful to treat such scattered values and to compare the results. To test the validity of the statistical performance, every test specimen must be taken at random from the whole sample and enough specimens should be prepared to show the inherent probability distribution of the property of the sample. This poses the problem of how many test samples are required and how to make them. A technique from mathematical statistics is applied to several rock types to determine the number of test specimens. Compressive and tensile strengths were determined on granite, andesite, and sandy tuff, which are typical of hard, medium hard, and soft rock. As a general conclusion, 10 or more specimens are required to determine the strength of a rock, even if all specimens are prepared from the same block of rock. (USBR)
W70-07889

8F. Concrete

EFFECT OF STRESS LEVEL ON CREEP AND CREEP RECOVERY OF LEAN MASS CONCRETE,
Bureau of Reclamation, Denver, Colo.

K. B. Hickey.
Bureau of Reclamation Report REC-OCE-69-6, Dec 1969. 12 p, 7 fig, 4 tab, 12 ref.

Descriptors: *Creep, *Elasticity (Mechanical), *Mass concrete, Stress, Concrete technology, Laboratory tests, Deformation, Concretes, Recovery, Concrete testing, Compressive strength.
Identifiers: Concrete properties, Sustained loads, Compressive stress, *Creep tests, Test results, *Creep recovery.

A test program was conducted to investigate the relationship between the intensity of sustained load and the creep of a typical mass concrete with low cement content similar to that used in concrete dams. Sets of sealed mass concrete cylinders were loaded initially in compression at ages of 28 and 90 days; the loads were sustained for over a year and creep was measured periodically. Creep of concrete loaded at 28 days is proportional to sustained stress only up to 15% of the 28-day compressive strength. Increases in creep deformations are noted at stresses greater than 15%. Concrete loaded at 90 days exhibits creep proportional to sustained stress up to 22% of the 90-day compressive strength. Creep recoveries of sealed concrete specimens unloaded after 400 days of continuous compression are proportional to sustained stress, regardless of the concrete age at load application. (USBR)
W70-07871

ANALYSIS OF SHRINKAGE EFFECTS ON REINFORCED CONCRETE STRUCTURAL MEMBERS,
University Coll., London (England); and Cement and Concrete Association, London (England).
Robert H. Elevery, and Muhamed Shafi.
Journal of the American Concrete Institute, Proceedings, Vol 67, No 1, p 45-52, Jan 1970. 8 p, 9 fig, 1 tab, 19 ref, append.

Descriptors: *Shrinkage, Concrete structures, *Reinforced concrete, Structural behavior, Structural design, *Structural members, Stress, Strain, Theoretical analysis, Analysis, Beams (Structural), Creep, Deformation, Deflection, Equations, Testing, Test procedures, Effects, Bibliographies, Foreign research.
Identifiers: Concrete properties, Concrete slabs, Warpage, *Analytical method, Great Britain.

Concrete shrinkage often causes considerable deformation and stress changes in concrete structures; these changes are usually of sufficient importance to require attention at the design stage. A theoretical method for predicting stresses and deformations caused by concrete shrinkage is presented. Predictions of the warping behavior of reinforced-concrete beams using the method show good agreement with experimental results, particularly in the case of singly reinforced beams in which warping is most severe. Testing to verify the method is described. Previous studies of the effects of concrete shrinkage on reinforced concrete members are discussed. (USBR)
W70-07873

ALUMINUM PIPE: SOURCE OF CONCRETE-PUMPING PROBLEMS.

Concrete Construction, Vol 15, No 1 and 3, p 12-13; 94-96, Jan, Mar 1970. 5 p.

Descriptors: Low alkali cement, *Portland cements, *Pumped concrete, *Aluminum, *Pipes, Hydrogen, Concrete construction, Coarse aggregates, Aggregates, *Concrete mixes, Concretes, *Concrete technology, *Concrete placing, Bubbles, Voids, Air entrainment.
Identifiers: Concrete properties, Recommendations.

Under certain conditions, concrete pumped through aluminum pipe has exhibited serious deficiencies, including reduction in compressive strength by about 50%, expansion of freshly molded test cylinders, placement difficulties, and problems in maintaining grade after placement. Investigations show that the alkalies in cement are capable of reacting with aluminum, generating hydrogen gas that may leave voids in the hardened concrete. One report mentioned bubbles bursting at the concrete surface that could be ignited. Recommendations are made that aluminum pumplines should not be used when: (1) the coarse aggregate is quite abrasive, (2) nonuniformly graded sand is used, (3) the mix is low-slump, (4) a high-alkali cement is used, (5) a low sand-aggregate is employed, or (6) no air is entrained in the concrete. (USBR)
W70-07875

PROTECTIVE REVETMENT OF RIVER EMBANKMENTS (IN FRENCH).
For primary bibliographic entry see Field 08A.
W70-07945

ECONOMICS OF BANK PROTECTION ON CANALS AND NAVIGABLE RIVERS (IN FRENCH),
Service Technique de la Direction des Ports Maritimes et des Voies Navigables (France).
For primary bibliographic entry see Field 08A.
W70-07947

8G. Materials

CAUSES AND PREVENTION OF COATINGS FAILURES,
National Association of Corrosion Engineers, Houston, Tex.
A. K. Long.
Material Protection, Vol 9, No 3, p 32-36, Mar 1970. 5 p.

Descriptors: *Corrosion control, *Protective coatings, *Painting, Paints, Primers (Painting), Failures, Inspection, Specifications, Steel, Maintenance, Chalking, Cracking, Chemical degradation, Deterioration, Chemical stability, Degradation, *Metal coatings, Steel structures.
Identifiers: Checking, Peeling, Delamination, Rusting, Blistering, Wrinkles, *Surface preparation.

This report discusses the failure of barrier-type protective coatings applied to steel surfaces, but does not include sacrificial-type zinc-rich coatings. Coating failures may be associated with the coating itself, application of the coating, or surface preparation. Ten common types of failures are: (1) chalking; (2) color fading or color change; (3) cracking, checking, and alligatoring; (4) peeling, flaking, and delamination; (5) rusting; (6) blistering; (7) lifting and wrinkling; (8) failures from chemical or solvent attack; (9) failure around weld areas; and (10) edge failures. Remedies and methods for preventing each type of failure are given. Past experience indicates that about 70% of all coating failures result from poor surface preparation. Although the blame is placed on surface preparation, the more realistic cause may be lack of proper specifications or inadequate inspection necessary to obtain the desired results. (USBR)
W70-07872

FIBROUS POLYMERS,
University of Strathclyde, Glasgow (Scotland).
R. Meredith.
Contemporary Physics, Vol 11, No 1, p 43-58, Jan 1970. 16 p, 8 fig, 1 plate, 3 tab, 7 ref.

Descriptors: *Fibers, *Synthetic fibers, *Polymers, Polyethylenes, Molecular structure, Cellulose, Proteins, X-ray diffraction, Reviews, Thermal properties, Mechanical properties, Electrical properties, Rheology, Viscosity, *Materials, Foreign research.
Identifiers: Great Britain, Synthetic resins, Vinyl resins, Acrylic resins, Polypropylene, Polyamides, Polyesters.

The molecular structure and physical properties of fibrous polymers are described and examples are given of the relations between them. Most fibrous material consists of long-chain molecules of carbon, hydrogen, oxygen, and nitrogen alined more or less parallel to each other. The most common molecular structures, the sequences of molecular building units, and cohesive forces that bind the molecules together are discussed; physical methods for investigating these structures are included. Special emphasis is given to mechanical properties and the application of mechanical vibrations for separating elastic and viscous responses. Rheological, thermal, and electrical properties and the improvement of these properties by grafting and copolymerization are covered. Some interesting uses and future developments are given. (USBR)
W70-07874

EXPERIENCE IN CONSTRUCTION OF POLYETHYLENE - CANALS,
V. A. Akopov.
Gidrotekhnika i Melioratsiya, No 4, p 35-39, 1969. Transl from Russian by the Bureau of Reclamation, Trans 833, April 1970. 12 p, 6 fig.

Descriptors: *Buried membranes, Canals, Foreign construction, Canal embankments, *Canal linings, Canal seepage, Cost comparisons, Blankets, Soil compaction, Impervious linings, *Polyethylenes, Canal design, Earth handling equipment, Economics, Joints (Connections), Foreign projects, Construction materials.
Identifiers: USSR, Turkmen SSR, Polyvinyl chloride, Seepage control, Construction methods.

Several Turkmen SSR design and construction organizations developed a trench method for installing buried membrane linings in canals to prevent seepage. Using this method to install a buried polyethylene lining in a large canal in desert soil with a 40-cu m/sec discharge was basically successful but not without difficulty. The canal had an 8-m-wide bottom and 2:1 side slopes. The trench had a 22-m-wide bottom 1 m below canal grade and 0.5:1 side slopes. Herbicide was applied before lining placement. The membrane, fabricated in 2 pieces by seaming smaller sheets with a household electric iron, was laid loosely on the trench surface and seamed along the canal centerline. Earth cover was placed on the bottom, spread by bulldozers, and compacted by rubber-tired rollers immediately after membrane placement to prevent ballooning of the lining. The remaining cover material was placed in layers and compacted. Compaction of the side-slope cover was difficult because of the small working area. About a fifth of the side-slope cover sloughed in during first-year operation and was replaced; little additional sloughing occurred after saturation. Total cost was 2.98 rubles/sq m of installed lining. More extensive use of PVC linings will depend on service life and property changes. (USBR)
W70-07884

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

DIRECTORY OF PERSONNEL, WATER RESOURCES IN WESTERN NEW YORK - THIRD EDITION, OCTOBER 1969.
State Univ. Coll., Buffalo, N.Y. Great Lakes Lab.
For primary bibliographic entry see Field 09C.
W70-07803

9B. Education (In-House)

ENGINEER VERSUS COMPUTER - A STRATEGY OF PERSUASION,
California State Div. of Highways, Sacramento.
For primary bibliographic entry see Field 06A.
W70-07855

C. Research Facilities

RECTORY OF PERSONNEL, WATER SOURCES IN WESTERN NEW YORK - IRD EDITION, OCTOBER 1969.
te Univ. Coll., Buffalo, N.Y. Great Lakes Lab.

eat Lakes Laboratory Publication, State Univer- College, Buffalo, NY, 1969. 189 p.

scriptors: *Personnel, *Water resources velopment, *New York, *Scientific personnel, iversities, Data collections, Research and velopment, Governments, Industries, Education. ntifiers: Water resources research, Directories.

directory lists workers in water resources in stern New York. The information in this directo- has been separated into three divisions-subject ex, personnel index and agency index. The in- iduals and agencies involved with a given aspect water resources such as aquatic life or drainage listed in the subject index. The addresses of h parties are listed in the agency index. (Knapp-GS)
70-07803

10. SCIENTIFIC AND TECHNICAL INFORMATION

NATIONAL SYSTEM FOR WATER DATA,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 07A.
W70-07663

SPRINKLER IRRIGATION--A BIBLIOGRAPHY SELECTED FROM FOREIGN LITERATURE,
Department of the Interior, Washington, D.C.
Ludmilla Floss.
Bibilography Series, No 15, Office of Library Services, Washington, D.C. Feb 1970. 54 p, 251 ref.

Descriptors: *Sprinkler irrigation, *Bibliographies, Foreign research, Foreign countries, Foreign design practices, Irrigation practices, Costs.

A bibliography of 251 references was compiled in response to many requests for recent foreign documents on sprinkler irrigation as distinguished from the domestic literature which can be obtained through normal sources. Modern sprinkler irrigation has revolutionized conventional procedures and is rapidly assuming an important place in many parts of the globe. The world demand for sprinkling equipment has grown to such great proportions that advanced studies in perfecting constructional solutions of such equipment are underway. Included in the bibliography are references to costs and economy of operation, equipment and systems of installation, and stationary and mobile methods of sprinkler irrigation; agricultural aspects have not been included. The references listed, with only a few exceptions, are from 1964 through summer 1969. The format is by country of publication, with an index of authors and names of organizations and government bodies concerned. A list of abbreviations used in the citations follows the bibliography. (USBR)
W70-07879

STATE OF THE ART REVIEW ON PRODUCT RECOVERY.
Resource Engineering Associates, Wilton, Conn.
For primary bibliographic entry see Field 05D.
W70-07997

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C. Others		
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OCTOBER 15, 1970

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 20
OCTOBER 15, 1970

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of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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MAL POLLUTION - BIOLOGICAL EF-S, A REVIEW OF THE LITERATURE OF

e-Northwest, Richland, Wash.
mary bibliographic entry see Field 05C.
8376

EFFECTS OF SUSPENDED AND SITED SEDIMENTS ON ESTUARINE OR-SMS; AN ANNOTATED BIBLIOGRAPHY LECTED REFERENCES,

nd Univ., Solomons. Natural Resources Inst.
mary bibliographic entry see Field 05C.
8386

Properties

RY OF LIQUIDS,

oo Univ. (Ontario).
s Henderson, and J. A. Barker.
le by Superintendent of Documents, US ment Printing Office, Wash, DC 20402 - 0.50. Office of Saline Water Research and pment Progress Report No 537, March 0 p, 12 fig, 2 tab, 28 ref. OSW Grant No 14-1-1325.

tors: *Water properties, *Water structure, ls, Molecular structure, Mechanical proper-ermodynamic behavior, Viscosity.
ers: Theory of liquids.

heories of simple spherical liquids are d. These are perturbation theory and the Yevick (PY) theory. When used properly ieories are of comparable accuracy and are tisfactory theories of liquids. Progress in the nation of intermolecular forces is discussed ent work on the theory of water is reviewed. ndamental concepts of the perturbation of liquids are that the structure of a simple s determined primarily by the repulsive etween the molecules and that the main ef-the attractive forces between the molecules rovide a uniform background potential in he molecules move. (Knapp-USGS)
510

ENT STATE OF THE PROBLEM OF R STRUCTURE,

Gurikov.
er in Biological Systems Consultants Bu-ew York, p 1-8.

tors: *Water structure, *Hydrogen bond-olecular structure, *Physicochemical pro-Ice, Thermodynamic behavior, Aqueous s, X-ray analysis.
ers: *Framework structure, *Clathrate ork, *Framework voids, *Bond-rupture Cold neutron scattering, Raman spectrun, -vibration spectrum, Dodecahedral struc-olecular orientation.

ed to other liquids the physicochemical es of water are highly unusual. The struc-water is of great importance with respect to operties, and framework defects have been ed as a special component of water struc-ecent studies on framework structure are d, and the principle concepts to emerge se studies are: (1) The great similarity of nd ice structures (2) The rupture of H-ith temperature increase (3) Two types of (centrosymmetric and mirror-symmetric) decahedral structure formation of the type (5) Characteristic temperature near here are abrupt changes in the properties cture of water. Framework defects, ranging nding of bonds to complete rupture, are y unimportant in ice but become an impor-ctural component in the liquid state. Two structural models of water are discussed: (1) Mosaic models in which water is treated as an ideal mixture of segments having an ice-like structure and segments with a more compact structure lacking H-bonds (2) Two-state models in which molecules at the junctions of 3-dimensional H-bond networks correspond to one state while molecules occupying framework voids correspond to the other. The ability of these models to account for various experimental phenomena is discussed. (Casey-Arizona)
W70-08528

1B. Aqueous Solutions and Suspensions

COLLIGATIVE PROPERTIES OF ANOMALOUS WATER,

Bristol Univ. (England). Dept. of Physical Chemistry.
D. H. Everett, J. M. Hayes, and P. J. McElroy.
Nature, Vol 226, No 5250, p 1033-1037, June 13, 1970. 5 p, 4 fig, 17 ref.

Descriptors: *Water structure, *Water properties, *Gels, *Silica, Colloids, Viscosity, Thermodynamics, Aqueous solutions, Physical properties, Vapor pressure, Water chemistry.
Identifiers: *Anomalous water, Polywater.

Investigations of the phase behavior on freezing and subsequent melting and of other properties indicate that anomalous water is a solution containing a fixed amount of relatively involatile material in normal water. There seems to be no need to postulate the existence of a new polymer of water in such solutions. If only water and silica are present, the properties are consistent with those of a silicic acid gel. (Knapp-USGS)
W70-08189

SALTING COEFFICIENTS FROM SCALED PARTICLE THEORY,

Connecticut Univ., Storrs. Dept. of Chemistry.
W. L. Masterton, and Tei Pei Lee.
Journal of Physical Chemistry, Vol 74, No 8, p 1776-1782, April 16, 1970. 7 p, 13 ref. OWRR Project H-013-CONN.

Descriptors: *Water chemistry, *Aqueous solutions, *Electrolytes, *Water properties, Solvent extractions, Ions, Saline water systems, Solubility, Desalination, Thermodynamics.
Identifiers: Salting coefficients.

Scaled particle theory is used to derive a general expression for the salting coefficient, ks, which appears in the Setschenow equation. This expression is essentially a sum of two terms, one of which will ordinarily be positive (salting out), while the other will be negative (salting in). Calculated values of ks are in excellent agreement with experiment for systems in which the molecular and ionic diameters are relatively small. For large molecules, the agreement is poorer, as is true with classical theories of the salt effect. The magnitude of ks is very sensitive to uncertainties in the diameters of anions and cations. (Knapp-USGS)
W70-08191

GENERAL PROBLEMS IN THE THEORY OF IONIC HYDRATION IN AQUEOUS SOLUTIONS,

Akademiya Nauk SSSR, Moscow. Institut Obshchei i Neorganicheskoi Khimii.
O. Ya. Samoilov.
Translated from Russian. In: Water in Biological Systems Consultants Bureau, New York, 1969, p 20-27. 6 fig, 1 tab, 29 ref.

Descriptors: *Aqueous solutions, *Hydrogen bonding, *Solubility, *Thermodynamic behavior, *Ionization, Sodium, Potassium, Dispersion, Solutions, Solvation.
Identifiers: *Ionic hydration.

An aqueous electrolyte solution is a heterodynamic system involving 3 types of interaction: (1) Ionic interactions which are long-range forces (2) Water molecule-ionic interactions (primarily ion-dipole) that weaken more rapidly with distance (3) Interactions between water molecules, with the formation of H-bonds which are short-range forces. The state of an ion in solution is governed not by the total interaction energies but principally by changes in energy over short distances. Positively hydrated ions such as Mg, Li, and Na ions strengthen the bonds between water molecules and their nearest neighbors, while K, Cs, and Cl ions are negatively hydrated with opposite effects. Experimental evidence for these phenomena is discussed. Negative hydration occurs only in those cases where solvent molecule interactions are sufficiently strong, and is displaced by positive hydration in aqueous solutions when temperature rises. This is due to rupture of H-bonds, decreasing solvent molecule interactions. Results of studies of the solubility of NaCl in methanol solutions with ethanol added, and in ethanol solutions with methanol added, accorded with the view that increases in structural stabilization of a solvent leads to decreases in solute solvation. (Casey-Arizona)
W70-08518

STRUCTURE OF WATER IN CRYSTALLINE HYDRATES OF CERTAIN BIOLOGICALLY IMPORTANT COMPOUNDS,

Akademiya Nauk SSSR, Moscow. Institut Obshchei i Neorganicheskoi Khimii.
G. G. Malenkov.
In: Water In Biological Systems Consultants Bureau, New York, p 28-37, 1969. 10 fig, 1 tab, 26 ref.

Descriptors: *Hydrates, *Hydrate processes, *Crystals, *Hydrogen bonding, *Water of hydration, Organic compounds, Organophosphorus compounds, Amino acids, Peptides, Biochemistry, Physicochemical properties, Cations, Anions.
Identifiers: *Copacking, *Law of densest packing, *Biopolymeric compounds, *Organic crystals, *Intermolecular interations, Nucleosides, Hydrophilic groups, Packing factor, Identity period, Electrostatic forces, Space filling.

Water is incorporated into simple and supermolecular biopolymeric compounds and serves both functional and structural roles. Determination of its precise localization is difficult, but it is known to obey the principle of densest packing in organic crystals. Crystals containing H have a tendency to form a maximum number of H-bonds, which only rarely conflicts with densest packing. When water is incorporated into organic crystals, copacking of the very small water molecules and the larger molecules occurs, leading to space filling and the most favorable conditions for H-bonding. The number, state, and distribution of the water molecules are determined by many characteristics of the main compound molecules such as shape and location of hydrophilic groups. The structures of the hydrates of several low nolecular weight biopolymers are described, particularly with reference to their H-bonding. Structures containing chains of water molecules must be arranged to conform with the physicochemical requirement for water of 4.5 angstrom unit identity periods along the chain. Examples of this are described for some linear and cyclic molecules. Compounds are also described in which electrostatic forces play a role in addition to H-bonds and intermolecular forces. Finally, the crucial importance of water in organic phosphates and hydrophosphates is considered. (Casey-Arizona)
W70-08527

02. WATER CYCLE

2A. General

STUDY OF WATERSHED HYDROLOGY BY THE WATERSHED EXPERIMENTATION SYSTEM,
Illinois Univ., Urbana. Dept. of Hydraulic Engineering.
Ven Te Chow.
Nature and Resources, Bulletin of the International Hydrological Decade, Vol 6, No 1, p 12-14, March 1970. 3 p.

Descriptors: *Watersheds (Basins), *Hydrology, *Laboratory tests, *Model studies, Hydraulic models, Computer models, International Hydrological Decade, Simulated rainfall, Hydrogeology, Rainfall-runoff relationships, Streamflow, Forecasting, Simulation analysis.
Identifiers: Illinois University, Hybrid hydraulic-computer models.

The Watershed Experimentation System (WES) developed in the Hydraulic Engineering Laboratory of the Department of Civil Engineering, University of Illinois, integrates electronic, hydraulic, pneumatic, and structural components. For research on hydraulic and hydrologic problems in engineering, the WES can generate an artificial storm of given temporal and spatial distributions of rainfall intensities and move it in any desired direction over an area of 40 x 40 ft or less in the laboratory. Within this area, a testing drainage basin can be built and its hydraulic and hydrologic parameters, including size, shape, slope, surface roughness, stream pattern and storage capacity can be represented and altered. The runoff from the basin is automatically measured by sonars and instantaneously transmitted to an electronic computer for processing and printing-out of the hydrograph. (Woodard-USGS)
W70-08182

A CONCEPTUAL MODEL OF THE GROUNDWATER REGIME AND THE HYDROGEOLOGIC ENVIRONMENT,
Research Council of Alberta, Edmonton.
J. Toth.
Journal of Hydrology, Vol 10, No 2, p 164-176, February 1970. 13 p, 1 fig, 9 ref.

Descriptors: *Hydrogeology, *Model studies, *Equations, *Mathematical models, Aquifers, Groundwater movement Hydrologic budget, Regime, Mathematical studies, Discharge (Water), Climates, Geology, Water chemistry.
Identifiers: Hydrogeologic environment, Groundwater regime.

A conceptual model for the description, explanation, prediction, and control of hydrogeologic conditions is composed of two systems of physical and chemical parameters: the Hydrogeologic Environment, and the Groundwater Regime. The three components of the environment, each comprising a great number of parameters, are topography, geology, and climate. The necessary and sufficient parameters of the groundwater regime are: (1) amount of water, (2) geometric distribution of water movement, (3) volume or velocity of the flow, (4) chemical composition, (5) temperature, and (6) regime variance. The environment and regime are related quantitatively and each regime parameter can be expressed mathematically as a function of the environmental components. This allows the evaluation of the groundwater regime if the environmental conditions are known, as well as inferences concerning the aquifer from known properties of the regime. To date few parameters have been evaluated exactly and mostly conceptual equations are presented. (Knapp-USGS)
W70-08208

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS - PART I - A DISCUSSION OF PRINCIPLES,
University Coll., Galway (Ireland). Dept. of Engineering.
For primary bibliographic entry see Field 02E.
W70-08211

PRECIPITATION, STREAMFLOW, AND MAJOR FLOODS AT SELECTED SITES IN THE GILA RIVER DRAINAGE BASIN ABOVE COOLIDGE DAM, ARIZONA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-08468

GROUNDWATER - SURFACE WATER RELATION DURING PERIODS OF OVERLAND FLOW,
Geological Survey, Indianapolis, Ind.
James F. Daniel, Louis W. Cable, and Ronald J. Wolf.
For sale by the Superintendent of Documents US Government Printing Office, Washington, DC 20402 - Price $3.25. In: Geological Survey Reasearch 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B219-B223, 1970. 5 p, 8 fig, 3 ref.

Descriptors: Surface-groundwater relationships, *Flood plains, *Bank storage, *Floods, *Overland flow, Base flow, Hydrograph analysis, Hydrographs, Aquifers, Alluvial channels, Indiana.
Identifiers: White River (Ind).

The groundwater exchange mechanism at the stream interface during periods of overland runoff was investigated by means of observation wells installed in the flood plain on the White River near Noblesville, Ind. Groundwater discharge decreases with the beginning of a stream rise, ceases after a short time interval, and then bank storage begins. A volume of discharge from the aquifer equal to that which entered as bank storage at the study site was dissipated 54 hours after an overbank peak, 42 hours after a medium peak and 50 hours after a small peak. The results were used to formulate a theoretical method for stream-hydrograph separation of base flow and overland flow. The separation method shows no groundwater runoff until bank storage and channel storage volumes have been dissipated. All discharge in the stream before and after this period is equal to that contributed by the aquifer system. (Knapp-USGS)
W70-08488

TRENDS IN RUNOFF,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02B.
W70-08491

THE RELATIONSHIP BETWEEN SURFACE WATER AND GROUNDWATER IN SHIP CREEK NEAR ANCHORAGE, ALASKA,
Geological Survey, Anchorage, Alaska.
For primary bibliographic entry see Field 02F.
W70-08492

2B. Precipitation

SPACE VARIATIONS OF PRECIPITATIONS FOR RAINAGE NETWORK DESIGN,
Agricultural Research Service, Danville, Vt. Soil and Water Conservation Research Div.
Robert L. Hendrick, and George H. Comer.
Journal of Hydrology, Vol 10, No 2, p 151-163, February 1970. 13 p, 11 fig, 1 tab, 5 ref.

Descriptors: *Distribution patterns, *Rainfall, *Network design, *Rain gages, Rainfall disposition, Correlation analysis, Demonstration watersheds, Topography, Statistical methods, Vermont.
Identifiers: Sleepers River Watershed (Vt).

Space variations of daily precipitation are examined in terms of the field of inter-station correlations over the Sleepers River Watershed in northern Vermont. The correlation field about a control gage is dependent on inter-station distance and azimuth, daily rainfall amount, and the season of the year. No dependence on elevation or elevation difference (slope) was found. A correlation field function is derived which is then used to determine raingage density and configuration required for specified accuracy of watershed precipitation estimates. (Knapp-USGS)
W70-08178

CLIMATIC ESTIMATES OF AVERAGE AND PROBABLE IRRIGATION REQUIREMENTS AND OF SEASONAL DRAINAGE IN CANADA,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
For primary bibliographic entry see Field 03F.
W70-08216

PROBABLE MAXIMUM PRECIPITATION FOR THE LOWER RIO GRANDE,
Weather Bureau, Silver Spring, Md. Office of Hydrology.
John T. Riedel.
Water Resources Bulletin, Vol 6, No 3, p 439-451, May-June 1970. 13 p, 8 fig, 6 tab, 5 ref.

Descriptors: *Probable maximum precipitation, *Rio Grande, *Hurricanes, *Flood forecasting, Precipitation (Atmospheric), Rainfall, Depth-area-duration analysis, Planning, Flood protection, International Boundary and Water Commission, Mexico, United States.
Identifiers: Lower Rio Grande Valley.

To aid in planning and design of additional flood protection on the Lower Rio Grande, the Hydrometeorological Branch prepared a probable maximum precipitation study for the International Boundary and Water Commission (United States and Mexico) and the Republic of Mexico. Five drainages from 2,000 to over 17,000 square miles in area between Falcon and Anzalduas Dams including Rio San Juan and Rio Alamo in Mexico are the areas of concern. The great rains of hurricane Beulah, September 19-24, 1967 verified that additional protection is needed. Procedures for estimating probable maximum precipitation (PMP) are described. A particular problem was to estimate rainfall potential for the Sierra Madre Oriental in Rio San Juan and Alamo drainages. These mountains form a north-south windward-facing slope and barrier of over 7,000 feet in elevation. A detailed study was made of rains from hurricane Beulah. The storm produced the greatest known rain depths in North America for 50,000 square miles or greater, and durations longer than 48 hours. (Knapp-USGS)
W70-08229

SNOW HYDROLOGY IN THE FOREST ENVIRONMENT,
British Columbia Univ., Vancouver. Dept. of Forestry.
For primary bibliographic entry see Field 02C.
W70-08240

DUSTINESS OF AIR DURING DUST STORMS ON THE MANGYSHLAK PENINSULA (IN RUSSIAN),
S. S. Kharitonova.
Meteorologiya i Gidrologiya, No 5, p 87-88, 1969. 2 p, 4 ref.

Descriptors: *Dust storms, *Air pollution, Wind velocity, Particle size, Wind erosion, Soil erosion, Air environment, Humidity, Air temperature, Sediment transport, Winds.
Identifiers: *Air quality measurements, Dust fall, USSR, Mangyshlak Peninsula.

Data are presented from observations of 220 dust storms studied during 1964-68 on the Mangyshlak

insula, USSR. The storms lasted from several utes to 18 hours each. Air samples for analysis e collected at heights of 3,10, and 20 m above ground, and measurements of atmospheric temature, humidity, and wind conditions were orded at the same time. Results showed that t storms are of local character, originating at d speeds higher than 6-7 m/sec and independt of wind direction. Dust particles of 0.01 - 0.25 ron predominated. The highest dust concentrain a storm was 245 mg/cu m at 3 m above the und. Highest average dustiness occurred in mer (40 mg/cu m). The most rapid decrease of t in the air was observed at heights between 3-n. (Lang-USGS)
0-08275

OBABLE MAXIMUM PRECIPITATION ER SOUTH PLATTE RIVER, COLORADO, D MINNESOTA RIVER, MINNESOTA,
ather Bureau, Washington, D.C. Office of drology.
n T. Riedel, Francis K. Schwarz, and Robert L. aver.
port available for sale by Superintendent of cuments, US Government Printing Office, shington, DC 20402 - Price $1.25. US Weather reau Hydrometeorological Report No 44, Janua-969. 114 p, 59 fig, 23 tab, 25 ref.

scriptors: *Probable maximum precipitation, ood forecasting, *Mississippi River, *Colorado, innesota, Weather forecasting, Snowmelt, Dis-ution patterns, Meteorology, Synoptic analysis, ximum probable flood, Weather data, Depth-a-duration analysis, Flood control; Planning.
ntifiers: *South Platte River (Colo), Minnesota er.

e great rain and snowmelt floods on the Upper ssissippi and its tributaries in April were among most disastrous ever experienced in these areas. r example, at Carver on the Minnesota River the vious high stage of 1952 was exceeded by 6 feet. other flood resulted in great damage along the uth Platte River in and near Denver from ex-mely heavy thunderstorm-type rainfall of about ours duration centered on upstream tributaries the south of Denver. Both floods were occa-ned by intense examples of common teorological processes in the respective regions d seasons -- snowmelt over a broad area in spring er the Upper Mississippi and intense short-dura-n storms to the immediate east of the Rockies ring the May-June maximum storm period of t area. The Hydrometeorological Branch of the eather Bureau prepared probable maximum cipitation estimates for these basins above spective dam sites in order to revise and update llway design floods. The basic method for esti-ting PMP is the transposition and moisture max-ization of storms. The two reports to the Corps Engineers have been incorporated into one lume in order to illustrate a variety of methods of imating probable maximum precipitation. (K-pp-USGS)
70-08277

ESHWATER ECOLOGY IN THE MATO ROSSO, CENTRAL BRAZIL I. THE CONDUC-VITY OF SOME NATURAL WATERS,
estfield Coll, London (England). Dept. of Zoolo-
r primary bibliographic entry see Field 02E.
70-08346

RENDS IN RUNOFF,
ological Survey, Washington, D.C.
H. Carrigan, Jr., and E. D. Cobb.
r sale by the Superintendent of Documents, US vernment Printing Office, Washington, DC, 402 - Price $3.25. In: Geological Survey search 1970, Chapter B, US Geological Survey ofessional Paper 700-B, p B214-B218, 1970. 5 p, ab, 29 ref.

Descriptors: *Precipitation (Atmospheric), *Climates, *Weather data, Forecasting, River forecasting, Climatology.
Identifiers: *Climatic trends.

Trend analysis of long-term precipitation records suggests that runoff is free of trend since at least 1830 over most of the world. The findings, reviewed in this report, of other investigators of hydrologic trends indicate that trends in runoff throughout much of the world seem to be nonexistent since the early part of the last century. (K-napp-USGS)
W70-08491

CLIMATE, SURVIVAL AND THE SECOND-CLASS SOCIETIES IN PALESTINE BEFORE 3000 B. C.,
Balliol Coll., Oxford (England).
For primary bibliographic entry see Field 06G.
W70-08538

2C. Snow, Ice, and Frost

SNOW HYDROLOGY IN THE FOREST ENVIRONMENT,
British Columbia Univ., Vancouver. Dept. of Forestry.
W. W. Jeffrey.
In: Snow Hydrology, Proceedings of Workshop Seminar at New Brunswick University, Fredericton, February 28-29, 1969; Published by Secretariat, Canadian National Committee for the International Hydrological Decade, Ottawa, p 1-19, 1970. 19 p, 9 fig, 7 tab, 59 ref.

Descriptors: *Snow management, *Forest management, *Water yield improvement, Snowpacks, Soil-water-plant relationships, Water conservation, Interception, Albedo, Water balance, Solar radiation, Evapotranspiration, Snowfall, Snowmelt, Runoff, Watershed management.
Identifiers: Snow hydrology, Canada.

The forest ecosystem differs from other vegetated sites primarily in its protusion of a large intercepting and radiating biomass above the snowpack surface and into the atmosphere. This protruding biomass is of highly complex and extremely variable three-dimensional geometry. The biomass, extending into the atmosphere for as much as 200 feet or more above the soil surface, affects wind movement and turbulent flux of sensible heat; it absorbs shortwave radiation and emits longwave; it modifies air temperature; it intercepts precipitation as rain, snow or fog; it transpires freely during the growing season, and perhaps to some extent over winter; it affects soil temperature, soil freezing and soil porosity; it influences the drainage pattern of cold air in sloping terrain. Most of the particular characteristics of the forest environment may be ascribed to the influence of this aerial biomass. Management of snow zone forests has potentialities for both desirable effects, as in larger flood peaks. (Knapp-USGS)
W70-08240

SNOW HYDROLOGY OF THE PRAIRIE ENVIRONMENT,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
D. M. Gray.
In: Snow Hydrology, Proceedings of Workshop Seminar at New Brunswick University, Fredericton, February 28-29, 1969: Published by Secretariat, Canadian National Committee for the International Hydrological Decade, Ottawa, p 21-33, 1970. 13 p, 7 fig, 4 tab, 10 ref.

Descriptors: *Snowpacks, *Grasslands, Snowfall, Snowmelt, Water balance, Water yield, Climatology, Snow surveys, Albedo, Solar radiation, Snow management.
Identifiers: Snow hydrology, Canada, Prairies.

Heat-budget or Energy-Budget equations are used to study the disposition of Prairie snowpacks. Unique features of the Prairie environment which affect the magnitudes of the heat components of the equation as compared to their evaluation in other regions of the country are discussed. On the Prairies, snow represents a main and vital source of the manageable fresh water supply. In these semi-arid regions, about 80-85% of the streamflow in the major river systems and the water stored in prairie dugouts and sloughs comes from the shallow snowpack. With the normal climatic conditions which prevail on the Prairies during the winter months, the net energy exchange is negative (outward) resulting in a lowering of the snowpack temperature below freezing (32 deg F), the amount of evaporation from the pack is negligible, and the net convective heat transfer to or from the pack is negligible. The relative importance of these components to the exchange changes at the time of melt or under Chinook conditions. (Knapp-USGS)
W70-08241

PROBLEMS OF MEASURING AND EVALUATING SNOWCOVER,
Canada Department of Transport, Toronto (Ontario). Meteorological Branch.
G. A. McKay.
In: Snow Hydrology, Proceedings of Workshop Seminar at New Brunswick University, Fredericton, February 28-29, 1969: Published by Secretariat, Canadian National Committee for the International Hydrological Decade, Ottawa, p 49-65, 1970. 17 p, 9 fig, 5 tab, 10 ref.

Descriptors: *Snow surveys, *Snowpacks, *Water equivalent, Snowmelt, Water yield, Snowfall, Precipitation (Atmospheric), Synoptic analysis, Winds, Vegetation effects, Energy budget, Water balance, Measurement.
Identifiers: Snow hydrology, Canada.

Snowcover measurements are required generally to determine the water equivalent or an index of the water equivalent over an area. Measurements of the structure of the cover are also necessary for the study of snow melt, trafficability and other properties. The water equivalent of snowcover and the character of the snow cover at a point can be measured with reasonable precision; however, there are difficulties in obtaining precise measurements of the water equivalent of the snow cover over an area. These difficulties arise from the heterogeneous nature of snowcover, and the limitations of instruments and measuring techniques. The heterogeneous character of the snowcover and the climatic controls which shape the pack are discussed to indicate the nature of the measurement problem. Only brief reference is made to measurements and instruments. (Knapp-USGS)
W70-08242

SNOW ACCUMULATION RELATED TO ELEVATION, ASPECT AND FOREST CANOPY,
Colorado State Univ., Fort Collins. Dept. of Watershed Resources.
J. R. Meiman.
In: Snow Hydrology, Proceedings of Workshop Seminar at New Brunswick University, Fredericton, February 28-29, 1969: Published by Secretariat, Canadian National Committee for the International Hydrological Decade, Ottawa, p 35-47, 1970. 13 p, 3 tab, 70 ref.

Descriptors: *Snowpacks, *Snow cover, Altitude, Forests, Vegetation effects, Elevation, Topography, Weather, Climates, Water yield, Water balance.
Identifiers: Snow hydrology.

North American studies on the relative magnitude of the effects of elevation, aspect, and the forest canopy on snow accumulation within the boundary conditions of atmospheric factors and major physiography of specific sites are reviewed. There are strong indications that accumulation, irrespective of melt, is related to aspect. This is generally

reflected in regionalization of accumulation areas but such effects may exist on a very localized basis as well. Generally the differences resulting from canopy influences tend to be smaller than those associated with elevational changes. The effects of elevation, aspect, and forest canopy on maximum snowpack water equivalent exhibit tremendous variability between and within given physiographic-climatic boundary conditions. (Knapp-USGS)
W70-08243

THE SYNTHESIS OF SNOWMELT HYDROGRAPHS,
Maine Univ., Orono. Water Resources Research Center.
W. Viessman, Jr.
In: Snow Hydrology, Proceedings of Workshop Seminar at New Brunswick University, Fredericton, February 28-29, 1969: Published by Secretariat, Canadian National Committee for the International Hydrological Decade, Ottawa, p 67-75, 1970. 9 p, 7 fig, 7 ref.

Descriptors: *Snowmelt, *Hydrographs, *Synthetic hydrology, *Hydrograph analysis, *Routing, Streamflow forecasting, Water yield, Water equivalent, Unit hydrographs, Time lag, Water storage.
Identifiers: Snow hydrology.

The synthesis of snowmelt or rainfall-snowmelt hydrographs is discussed. It is likely that such hydrographs are more difficult to adequately generate than those produced by other antecedent conditions. Not only must the usual basin parameters and losses be considered, but in addition the snowmelt process becomes exceedingly important. It is also necessary to consider periods of continued rainfall and snowmelt. Another complicating factor is that the usual system of categorizing losses is not generally applicable. Rain-on-snow or snowmelt-only hydrographs are usually synthesized through the use of unit hydrographs or storage routing techniques. In either case the effective input must be determined. This requires a fundamental knowledge of the drainage basin and snowpack characteristics. The computed outflow cannot be expected to be any more reliable than the finally estimated input. Hydrographs might be synthesized by considering the basic differential equations governing fluid flow. As research continues and computer capacity increases, such an approach will likely become a practical working tool. (Knapp-USGS)
W70-08244

CONDITONS UNDER WHICH SOLAR RADIATION PENETRATES INTO ICE,
S A Shishokin
Transl from Transactions of the Kazakh Hydrometeorological Scientific Research Institute (Trudy KazNIGMI), No 32, p 129-138, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 98-106, 1969. 9 p, 5 fig, 4 tab, 7 ref

Descriptors: *Solar radiation, *Ice, *Albedo, Cryology, Heat balance, Melting, Instrumentation, Measurement
Identifiers: Ice transparency, USSR

Penetration of solar radiation into ice depends on solar height, the type of radiation, the structure of the ice, its thickness, and its degree of decay. Actinometric observations were made on the radiation regime of the ice cover on the Ili River, USSR, in the spring of 1963 and in the upper pool of the Krasnoyarsk hydroelectric power station in 1964. Global radiation and the radiation reflected from the surface of the sample were determined at the beginning and end of a series of measurements of radiation intensity in the ice. To exclude the influence of reflection from the surfaces surrounding the ice, an albedometer was installed at a height of 19.5 cm. In the absence of local impurities, the intensity of radiation reflected from the ice is the same. Most intense light attenuation occurs in a relatively thin surface layer for all types of ice. The thickness of this layer is less than 5-6 cm for water and slush ice. It is approximately 25 cm for snow-slush ice and corresponds to the lower boundary of the snow ice layer. In the layer of intense light attenuation, the amount of penetrating radiation decreases by a factor of 2.2 in monocrystalline ice, a factor of about 3.5 in slush ice, and a factor of 7-8 in snow ice. Below this layer, radiation intensity decreases relatively slowly, nearly linearly. (Knapp-USGS)
W70-08255

PROBABILITY CHARACTERISTICS OF THE FREEZE-UP AND BREAKUP DATES OF RIVERS,
B. M. Ginzburg.
Transl from Trudy Gidromet. Tsentra, No 40, p 21-39, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 64-78, 1969. 15 p, 4 fig, 9 tab, 26 ref.

Descriptors: *Ice breakup, *Freezing, *Rivers, *Navigation, *Forecasting, Statistical methods, Probability, Ice jams, Data collections, Hydrologic data.
Identifiers: USSR.

The statistical methods used to predict ice breakup and freezing of rivers in the USSR are outlined. The length of the observational records for the major navigable rivers of the European USSR is at least 60 years in most cases. The records for Siberian rivers were shorter, but for the waterways, except in the Arctic, they were at least 40 years and in West Siberia and for the Amur, 50 years. Nearly all stations on the rivers of the European USSR with records of less than 40 years, and on rivers in the Asiatic USSR with records of less than 30 years, are located on small, intermittently navigable rivers. Thus, fairly limited samples served as initial material for the construction of integral probability curves. The accuracy in the determination of dates of different integral probability is characterized by a probable error close to observation accuracy and a limiting error at a 5 per cent significance level close to the corresponding error in the computation of the average date. (Knapp-USGS)
W70-08267

SNOW STORAGE DISTRIBUTION IN RIVER BASINS,
V. V. Rakmanov.
Transl from Trudy Gidromet. Tsentra, No 37, p 52-69, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 49-63, 1969. 15 p, 5 fig, 7 tab, 8 ref.

Descriptors: *Snow cover, *Snowpacks, *Water yield, *Water storage, *Probability, Statistical methods, Distribution patterns, Snow surveys, Runoff forecasting.
Identifiers: *USSR, Snow cover distribution.

Methods of computing the total snow storage distribution in river basins are described. They can be used in any region if the network of snow survey points is adequate and permits determination of the basin distribution of storage and if it is possible to select appropriate typical local distribution curves. The use of typical curves to describe snow storage distribution is entirely justified only for relatively small basins or those areas of larger basins where the average snow storage at separate points differs little from the total average value in the basin. For a large basin, snow storage distribution depends not only on its variation over each given area, but also on the variation in average snow storage in areas of the basin relative to their total average value in the basin. (Knapp-USGS)
W70-08268

HEAT TRANSFER COEFFICIENT IN WATER BODIES WITH LIMITED FLOWAGE DURING SUMMER HEATING,
K. I. Rossinskiy, and M. P. Kravtsova.
Transl from Trudy Gos. Gidrol. Inst-ta, No 162, p 205-220, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 27-38, 1969. 12 p, 5 fig, 2 tab, 9 ref.

Descriptors: *Heat transfer, *Lakes, *Turbulence, *Cold regions, Convection, Conduction, Heat flow, Mass transfer, Temperature, Mixing, Solar radiation.
Identifiers: USSR, Great Bear Lake (Canada).

In small bodies of water with active through-circulation, the basic heat transfer agent throughout the year is turbulent water flow. In deep water bodies with limited flowage, heat transfer occurs during different seasons and in different parts of the water bodies under the influence of different factors. At the onset of summer heating, until the surface layer temperature reaches 8 deg C, the transfer of heat occurs through the joint effect of convective and intensive mixing of waters due to the turbulence-producing effect of the wind. During the period from the spring breakup to spring isothermy, heat transfer occurs under the influence of free convection and mixing induced by the wind. During the period of isothermy, the main heat transfer processes are played by free convection. Observations made during the summers of 1964 and 1965 in Great Bear Lake (Canada) revealed that convective currents usually occupy considerable water depths, as deep as 225 m, whereas during cold years, when there is lesser heating, they extend to the very bottom, as deep as 450 m. (Knapp-USGS)
W70-08269

WATER PERMEABILITY OF FROZEN SOILS IN THE CENTRAL CHERNOZEM PROVINCE,
For primary bibliographic entry see Field 02G.
W70-08272

WORKSHOP ON SNOW AND ICE HYDROLOGY.

Proceedings of the Workshop on Snow and Ice Hydrology, Colorado State University, Fort Collins, August 18-22, 1969; published by US National Committee for International Hydrological Decade, 1969. 142 p.

Descriptors: *Water resources development, *Snow management, *Hydrology, *Conferences, *International Hydrological Decade, Avalanches, Glaciers, Snowpacks, Snowfall, Streamflow forecasting, Runoff forecasting, Melting, Ablation, Regimen, Snow surveys, Remote sensing, Research and development.
Identifiers: Snow hydrology.

The primary objective of the Workshop was to improve communications among those from various professional backgrounds and geographical regions having a common interest in snow and ice. The state of the art of snow and ice hydrology was explored and an attempt was made to identify and define some of the major problems and possible solutions. Emphasis was placed on hydrologic relations of the seasonal snow cover. Much of the discussion was pertinent to both seasonal snow cover and perennial snow and ice. (Knapp-USGS)
W70-08276

NEARSHORE UNDER ICE WATER MOVEMENT AT NANTICOKE, LAKE ERIE - 1970,
Ontario Water Resources Commission, Toronto. Great Lakes Water Quality Surveys Program.
For primary bibliographic entry see Field 02H.
W70-08479

2D. Evaporation and Transpiration

WATER BALANCE OF SOME WARM DESERT PLANTS IN A WET YEAR,
Nevada Univ., Reno. Desert Research Inst.
N. Stark.
Journal of Hydrology, Vol 10, No 2, p 113-126, February 1970. 14 p, 5 fig, 1 tab, 7 ref. NSF Grant No GB 6681.

Descriptors: *Soil-water-plant relationships, *Deserts, *Water balance, *Water loss, *Wate

orage, Arid lands, Arid climates, Water supply, ainfall, Precipitation (Atmospheric), Soil water ovement, Recharge, Infiltration, Evaporation, ranspiration, Evapotranspiration, Air tempera- re, Humidity.
entifiers: Death Valley (Calif).

udies of the water balance on a hectare of avelly wash in northern Death Valley showed at in an exceptionally wet year, the plants can ob- in moisture from free soil water and the conden- tion of soil water vapor in March. In May, with gher soil temperature extremes, distillation and ndensation in the 20 to 40 cm soil zone provided ore than enough water to make up for the water ss from evapotranspiration. By June, the rate of ater loss and other physiological processes were eatly decreased. Distillation and condensation in ne did adequately supply transpiration water loss uring a cloudy, cool period. Transpiration of the ur dominant species based on grams of water lost er gram of dry weight varied from March through ne by species. Internal water stress correlated osely with transpiration rates. Diurnal increase in ternal moisture stress generally followed the ecrease in the transpiration rate in June. From larch 10 through June 10, input was 2.6 g/sq cm, vapotranspiration was 4.0 g/sq cm, and soil oisture loss was 1.0 g/sq cm. The difference etween soil moisture loss and evapotranspiration sses was 0.4 g/sq cm which is the result of mea- uring soil moisture outside of the root zone instead f within the root zone. (Knapp-USGS)
/70-08175

OME ISOPLETH MAPS BASED ON LYSIME- ER OBSERVATIONS IN THE BRITISH ISLES N 1965, 1966, AND 1967,
ature Conservancy, Huntingdon (England).
. H. W. Green.
ournal of Hydrology, Vol 10, No 2, p 127-140, ebruary 1970. 14 p, 3 fig, 7 ref.

escriptors: *Evapotranspiration, *Evaporation, Mapping, *Contours, Hydrologic budget, Water alance, Surveys, Synoptic analysis, Lysimeters, etworks, Instrumentation.
dentifiers: *British Isles, *Isopleths, Potential vaporation.

small network of standardized observations of otential Evaporation is in operation in the United ingdom and the Republic of Ireland. Tentative opleth maps, based on these observations, are resented, and discussed, for the years 1965, 1966, nd 1967, together with maps of Potential Water eficit. Some comparison is made with maps from ther sources. (Knapp-USGS)
/70-08176

YDROGEN ISOTOPIC FRACTIONATION OF VATER PASSING THROUGH TREES,
eological Survey, Denver, Colo.; and Agricultural esearch Service, Fort Collins, Colo.
or primary bibliographic entry see Field 02K.
/70-08186

VAPOTRANSPIRATION MEASUREMENT BY HLORIDE TRANSLOCATION,
gricultural Research Service, Reno, Nev. Soil and Vater Conservation Research Div.
.. S. Dylla, and D. M. Stuart.
ournal of Hydrology, Vol 10, No 2, p 185-192, eb 1970. 8 p, 2 fig, 3 tab, 7 ref.

escriptors: *Evapotranspiration, *Soil chemistry, Root zone, *Mass transfer, *Soil water move- ent, Chlorides, Saline water systems, Leaching, oil-water-plant relationships, Water chemistry, olutes.
dentifiers: Chloride translocation.

rofiles in evapotranspiration tanks were sampled t the start and end of the 1968 growing season to etermine chloride ion translocation into the top 0 cm of the soil by which seasonal evapotranspira- tion was estimated. Coefficients of variation between profile totals ranged from 0.11 to 0.21 for the profiles sampled in April and from 0.39 to 0.45 for profiles sampled in October. The lower variation in April is attributed to the pre-season leaching. The greatest increase in chlorides in the vegetated tanks occurred in the top 15 cm; however, there was significant increase in all sample increments down to 60 cm, which is about the depth of the meadow grass rooting. Variability of total chlorides in adjacent soil profiles of vegetated surfaces makes the method of determining seasonal or long-term evapotranspiration from chloride translocation only a rough estimate. To obtain valid mean chloride profiles from which good evapotranspiration estimates could be expected would require very extensive soil sampling and nonchanging groundwater quality below the root zone during the measuring interval or season. (Knapp-USGS)
W70-08210

SOIL MOISTURE TENSION TRANSIENTS ASSOCIATED WITH EVAPOTRANSPIRATION FROM A WATER TABLE,
Agricultural Research Service, Fresno, Calif. Field Station.
W. C. Bianchi, and Rhys Tovey.
Soil Science Society of America Proceedings, Vol 34, No 3, p 496-501, May-June 1970. 6 p, 9 fig, 2 tab, 9 ref.

Descriptors: *Lysimeters, *Moisture tension, *Evapotranspiration, *Unsaturated flow, *Root zone, Diffusivity, Capillary fringe, Water table, Tensiometers, Soil water movement, -Water balance, Instrumentation, Irrigation, Strain gages.
Identifiers: Straingage tensiometers.

Soil moisture tensions were recorded continuously in lysimeters containing a loam soil and a controlled water table. Seven strain gauge-pressure transducer-tensiometers were spaced from 20 to 110 cm above the 158-cm water table. The velocity at which the morning and evening soil moisture tension minimum and maximum progressed downward through the root zone and capillary fringe proved inconsistent with soil moisture flow theory. This was interpreted as showing that even at low tensions a decrease in the moisture film continuity between the soil and tensiometer bulb relative to that between the few roots in contact with the bulb, caused the measurement to be biased toward the tensions associated with the root system. When the minimum daily tension exceeded 400 cm, soil-bulb continuity was lost and, as a result, the characteristic wave form of daily evaporation (ET) demand was also lost. By placing the tensiometers in the capillary fringe where roots are absent, they could record the changing demands of ET on the capillary fringe. A method was tested for estimating water table uptake from a diffusivity based on the velocity of propagation of tension waves induced into the soil profile by daily ET and associated diurnal gradient changes. (Knapp-USGS)
W70-08225

EVAPORATION AND CONDENSATION ON BARE SOIL UNDER IRRIGATION IN THE EAST CENTRAL GREAT PLAINS,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
Norman J. Rosenberg.
Agronomy Journal, Vol 61, No 4, p 557-561, July-August 1969. 3 tab, 27 ref. OWRR Project A-001-NEB.

Descriptors: *Evaporation, *Condensation, *Advection, *Irrigation effects, *Great Plains, Evapotranspiration, Dew, Rainfall, Environmental effects, Irrigation, Drying, Irrigated land, Semiarid climates, Nebraska, Heat transfer, Lysimeters.
Identifiers: *Net radiation, *Oasis effect, *Bare soil, *Potential evaporation, *Nocturnal evaporation.

Precision weighing lysimeters were used during the summer and fall of 1966 to measure evaporation from bare Sharpsburg sandy clay loam at Mead, Nebraska. Maximum daily evaporation was about 9 mm during August and about 3 mm during October. On days following a rain the evaporation from bare soil was in close agreement with available total net radiation, but on days following irrigation of only the lysimeters and buffer area the E/Rn was significantly greater than unity. This would indicate a strong oasis effect with a large advectional contribution of energy. From 10 to 50% of the total daily evaporation was nocturnal, the higher proportions occuring during the fall. Dew was detected on most mornings and the maximum deposition measured was about 0.5 mm. Both the Penman and van Bavel methods of estimating evaporation varied from lysimetrically measured evaporation by 3 to 50% on a daily basis, but the Penman method yielded lower estimates of bare soil evaporation. (Carr - Arizona)
W70-08352

OBJECTIVES, METHODS, AND ENVIRONMENT--GILA RIVER PHREATOPHYTE PROJECT, GRAHAM COUNTY, ARIZONA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 03B.
W70-08467

WINDS OVER SALTCEDAR,
Geological Survey, Lubbock, Tex.
T. E. A. Vay Hylckama.
Agricultural Meteorology, Vol 7, p 217-233, 1970. 17 p, 9 fig, 2 tab, 21 ref.

Descriptors: *Evapotranspiration, *Turbulence, *Wind velocity, *Tamarisk, Phreatophytes, Evapotranspiration control, Water yield improvement, Meteorology, Arizona, Consumptive use, Water loss.
Identifiers: Wind profiles.

An analysis of hourly wind speeds above and within a stand of saltcedar near Buckeye, Arizona, reveals that in 90% of all observed cases, the wind profiles above the stand can be represented by a simple logarithmic equation. The roughness length (disregarding zero displacement), varies with a stability ratio similar to Richardson's number. The friction velocity, depends on the wind speeds above the vegetation. Within the thickets there is considerable turbulence, and irregular wind inversions occur during daylight hours. The results are important for estimating water losses by evapotranspiration by either the energy-budget or the mass-transfer formulae. (Knapp-USGS)
W70-08469

ENERGY BALANCE ESTIMATES OF EVAPOTRANSPIRATION,
Oregon State Univ., Corvallis. Dept. of Forest Climatology.
Lloyd W. Gay.
In: Water Studies in Oregon; Oregon State University Water Resources Research Institute Fall Quarter 1969 Seminar WR012.69 Corvallis, p 17-39, January 1970. 23 p, 11 fig, 1 tab, 16 ref.

Descriptors: *Evapotranspiration, *Energy budget, *Microclimatology, Microenvironment, Soil-water-plant relationships, Water yield improvement, Forests, Wetlands, Deserts, Grasslands.
Identifiers: Pacific Northwest.

The role of vegetation in the evapotranspiration process is described to show the importance of this process in the establishment of a surface energy balance. Application of energy balance theory was demonstrated by the field experiments carried out over two contrasting sites, a pumice desert and a lush wet meadow in the Pacific northwest. Analysis to two similar days indicated that the wet meadow evaporated 5.1 mm (0.2 in) for the period 0730-1930 PDT; this was about six times the evaporation estimated over the pumice desert for the same

period. The lack of water available for vaporization at the pumice site caused major differences in the surface energy balances of the 2 sites. The resulting microclimate effects are quite important in the zone where plant growth would take place near the surface. (See also W70-08475). (Knapp-USGS)
W70-08477

EVAPORATION FROM LAKE TIBERIAS: AN ESTIMATE BY THE COMBINED WATER BALANCE-MASS TRANSFER APPROACH,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 02H.
W70-08534

2E. Streamflow and Runoff

STUDY OF WATERSHED HYDROLOGY BY THE WATERSHED EXPERIMENTATION SYSTEM,
Illinois Univ., Urbana. Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 02A.
W70-08182

A NOTE ON THE RECOGNITION, CAUSE, AND POSSIBLE GEOLOGIC IMPORTANCE OF GROUNDWATER MICROFLOW SYSTEMS IN ALLUVIAL-CHANNEL BED-FORMS,
Wisconsin State Univ., Oshkosh. Dept. of Geology; and North Dakota Univ., Grand Forks. Dept. of Geology.
Samuel S. Harrison, and Lee Clayton.
North Dakota Academy of Science Proceedings, Vol 22, p 9396, 1968. 4 p, 2 fig, 1 ref.

Descriptors: *Sedimentary structures, *Surface-groundwater relationships, *Dunes, *Ripple marks, Channel morphology, Alluvial channels, Alluvium, Groundwater movement, Seepage.
Identifiers: Groundwater microflow systems.

Groundwater microflow systems in natural bed-forms were noted during experiments on sediment transport in laboratory flumes. Ripple bed-forms consisting of medium sand injected with dye showed incipient movement of the dye through the sand after an elapsed time of 5 minutes. Dye movement was greatest beneath the gently sloping upstream side of the bed-forms. Water from the stream channel enters the upstream side of the bed-forms, flows in a concave-upward arc downstream, and emerges at the crest of the bed-forms. Water which enters the stream bed less than roughly 1/2 wavelength in front of the bed-form crest flows in an arc upstream and emerges at the nearest crest. The microflow is caused by pressure variations from the hydrostatic on the surface of the bed-forms. The pressure on the bed-form surface is greatest in the low areas above the crests. (Knapp-USGS)
W70-08207

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS - PART I - A DISCUSSION OF PRINCIPLES,
University Coll., Galway (Ireland). Dept. of Engineering
J. E. Nash, and J. V. Sutcliffe.
Journal of Hydrology, Vol 10, No 3, p 282-290, Apr 1970. 9 p, 2 fig, 3 ref

Descriptors: *Model studies, *Streamflow forecasting, *River forecasting, *Mathematical models, *Statistical models, Rainfall-runoff relationships, Flood forecasting, Parametric hydrology, Optimization, Systems analysis, Regression analysis.
Identifiers: Model fitting

The principles governing the application of the conceptual model technique to river flow forecasting are discussed. The necessity for a systematic approach to the development and testing of the model is explained and some preliminary ideas suggested. (Knapp-USGS)
W70-08211

DERIVATION OF FORMULAE FOR VARIABLE LAG TIME,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
Arthur J. Askew.
Journal of Hydrology, Vol 10, No 3, p 225-242, Apr 1970. 18 p, 6 fig, 2 tab, 13 ref.

Descriptors: *Flood routing, *Time lag, Small watersheds, Flood forecasting, Hydrograph analysis, Hydraulics, Open channel flow, Discharge (Water), Floods, Equations, Mathematical studies.
Identifiers: Lag time formulae.

Formulae are developed which permit the computation of lag time for a catchment as a variable dependent on flood magnitude. Nonlinearity, as demonstrated by the variation in lag, differs little from catchment to catchment, and what difference there is can only be weakly related to the catchment's characteristics. A highly simplified analysis of the stream channels indicates that they are subject to a nonlinear hydraulic response of the same order of magnitude as that measured in the catchments as a whole. It is therefore suggested that the nonlinearity associated with the catchment areas is chiefly the result of that to be found in their channel systems. The absolute magnitude of lag time is highly correlated with catchment area and slope. This correlation leads to the development of three formulae for use with ungaged catchments which closely resemble those developed in the past for the estimation of a constant lag time. (Knapp-USGS)
W70-08212

RETURN PERIODS IN THE PRESENCE OF PERSISTENCE,
Lancaster Univ., Bailrigg (England). Dept. of Mathematics.
E. H. Lloyd.
Journal of Hydrology, Vol 10, No 3, p 291-298, Apr 1970. 8 p.

Descriptors: *Flood forecasting, *Markov processes, *Probability, *Frequency analysis, Statistical methods, Stochastic processes, Streamflow forecasting.
Identifiers: Flood frequencies.

Defining an n-year flood as one for which the return period, i.e. the expectation of the interval T between floods is $n = 1/p$ years, the statistical variability of T is considered in the two cases where the statistical properties of the river flows in different years are (1) mutually independent and (2) serially correlated by means of a Markov Chain. (Knapp-USGS)
W70-08214

BEHAVIOR OF ANNUAL FLOODS IN LIMESTONE BASINS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Elizabeth L. White, and Brian M. Reich.
Journal of Hydrology, Vol 10, No 2, p 193-198, Feb 1970. 6 p, 4 fig, 4 ref.

Descriptors: *Floods, *Surface-groundwater relationships, *Karst, *Pennsylvania, Hydrogeology, Aquifers, Limestones, Caves, Fissures (Geology), Geology, Springs, Small watersheds.
Identifiers: Mean annual flood.

The relations between flood data and watershed features were examined in small basins in Pennsylvania. The specific flood parameter used was the mean of the annual series of floods, which corresponds to the flood with a recurrence interval of 2.33 years. Extremely low mean annual floods occurred where there was extensive thick limestone above base level within the basin. The explanation is that storm excess waters enter the groundwater storage and then resurge slowly over the next few days. This results in lower floods for a given size of carbonate basin. (Knapp-USGS)
W70-08217

TURBULENCE MEASUREMENTS IN LIQUIDS USING AN IMPROVED TOTAL PRESSURE PROBE,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
For primary bibliographic entry see Field 07B.
W70-08226

DETERMINATION OF CHANNEL CAPACITY OF THE TUOLUMNE RIVER DOWNSTREAM FROM LA GRANGE, STANISLAUS COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
J. C. Blodgett, and Hugh T. Mitten.
US Geological Survey Open-file report, 1970. 38 p, 10 fig, 5 plate, 4 tab, 6 ref, 5 append.

Descriptors: *Floods, *Stage-discharge relations, Flood plains, *Backwater, *California, Flood control, Flood protection, Non-structural alternatives, Historic flood, Frequency analysis, Hydrologic data, Data collections, Profiles, Probability.
Identifiers: Modesto (Calif), Tuolumne River (Calif), Flood profiles, Flood frequencies, Inundation.

The adequacy of a 52-mile reach of the Tuolumne River, Calif. to carry flood flows is described in a channel capacity report based on records of streamflow, historical and computed flood heights, and recorded backwater conditions. Maps, photographs, profiles, cross-sections, stage-discharge relations, and a backwater probability curve, indicate the extent of flooding that has occurred and may be expected to occur in the future. The flood data may be used to define the primary flood-way, and minimize vulnerability to flood damages by control of flood plain use through formulation of flood plain regulations, zoning regulations, and building codes. The report is intended to assist individuals, industry, and government in the planning of recreational, waste disposal, and flood protection facilities. (Knapp-USGS)
W70-08237

FLOOD PROFILE STUDY, MORGAN CREEK, LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
Harlan H. Schwob.
US Geological Survey Open-file report, May 1970. 16 p, 10 plate, 3 ref.

Descriptors: *Floods, *Iowa, *Flood plain zoning, *Profiles, Water levels, Stage-discharge relations, Flood protection, Flood plains, Water resources development, River basin development, Urbanization.
Identifiers: Cedar Rapids (Iowa), Linn County (Iowa), Morgan Creek (Iowa).

Profiles were computed for a large flood of Morgan Creek, Iowa under existing conditions and for a smaller flood for two assumed conditions of encroachment. Flood-plain management can benefit from this type of information during future expansion of the Cedar Rapids urban area. Morgan Creek is a small right-bank tributary of the Cedar River near the northwestern part of Cedar Rapids. The area drained at the mouth is 18.9 square miles--approximately two-thirds of which is in Linn County and the remainder, 6.71 square miles, is in Benton County. The land in the basin is gently rolling and is now virtually all used for agricultural purposes. Standard methods of step-backwater computation were used to define water-surface profiles for the larger flood discharge that defines the inundation level. (Knapp-USGS)
W70-08247

PEN CHANNEL APPLICATIONS FOR ILUTE POLYMER SOLUTIONS,
ueen's University of Belfast (Northern Ireland).
ept. of Civil Engineering.
or primary bibliographic entry see Field 08B.
/70-08257

ROBABILITY CHARACTERISTICS OF THE REEZE-UP AND BREAKUP DATES OF IVERS,
or primary bibliographic entry see Field 02C.
/70-08267

ISTRIBUTION OF ESTIMATES OF QUAN-ILES COMPARED BY DIFFERENT METHODS AS APPLIED TO STREAMFLOW COMPUTA-IONS),
'e. G. Blokhinov.
ransl from Trudy Gos. Gidrol. Inst-ta, No 162, p 8-36, 1969. Soviet Hydrology: Selected Papers, ssue No 1, p 11-26, 1969. 16 p, 8 fig, 4 tab, 6 ref.

Descriptors: *Statistical methods, *Data rocessing, *Hydrologic data, *Sampling, Proba-ility, Runoff forecasting, Streamflow forecasting, lood forecasting.
dentifiers: Quantile computations.

Different methods for evaluating the parameters of he probability distribution of runoff are described n the basis of observational data and the methods nost applicable to river runoff are selected. Analy-is of the characteristics of sampling distributions nvolves: (a) evaluation of standard distribution arameters; (b) evaluation of the quantiles applica-le to computations of runoff, water discharges or olumes of different excess probability; and (c) valuation of more complex functions of distribu-ion parameters. Evaluations of the quantiles were omputed and compared using: (1) moments nethods; (2) maximum likelihood method applica-le to a gamma distribution; and (3) a number of ew methods developed during recent years which re close in accuracy to the maximum likelihood nethod. (Knapp-USGS)
W70-08270

FUNDAMENTAL PRINCIPLES OF THE METHOD FOR COMPUTING MAXIMUM RUNOFF,
S. N. Kritskiy, and M. F. Menkel.
Trudy Gos. Gidrol. Inst-ta, No 162, p 3-17, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 1-10, 1969. 10 p, 3 fig, 1 tab, 7 ref.

Descriptors: *Reservoir design, *Streamflow forecasting, *Probability, River forecasting, Frequency analysis, Design flow, Design flood, Design standards, Statistical methods.
Identifiers: USSR.

The concept used as a theoretical basis of computations at the present stage in the USSR in climatology and hydrology is the concept of streamflow fluctuations as a random process. An estimate of the possible future maximum water discharges becomes definite only to the extent to which the discharge corresponds to its excess probability. All methods for computing maximum water discharge are based on an analysis of data on maximum runoff and the meteorological phenomena causing it as observed in the past. The criterion for determining maximum water discharge is the annual probability that this quantity will be exceeded. Information on fluctuations of maximum water discharge is limited for each individual river to the number of years during which hydrometric observations have been made. The reservoir design philosophy of the USSR is explained and reviewed. (Knapp-USGS)
W70-08271

FLOODS ON ROCK RIVER IN NORTHERN ROCK COUNTY, WISCONSIN,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-08283

FLOODS IN BEDEN BROOK BASIN IN SOMERSET AND MERCER COUNTIES, NEW JERSEY,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07C.
W70-08284

FRESHWATER ECOLOGY IN THE MATO GROSSO, CENTRAL BRAZIL I. THE CONDUCTIVITY OF SOME NATURAL WATERS,
Westfield Coll, London (England). Dept. of Zoology.
J. Green.
Journal of Natural History, Vol 4, p 289-299, 1970. 6 fig, 7 tab, 11 ref.

Descriptors: *Conductivity, *Tropical regions, *Impact (Rainfall), *Precipitation (Atmospheric), *Runoff, Calcium, Water properties, Hydrologic cycle, Streams, Meanders, Percolation, Sodium.
Identifiers: *Brazil, *Mato grosso, Cerrado.

The conductivities of streams, meander lakes, rainfall, and runoff water were measured in a region of the Mato Grosso. The streams and meander lakes had low conductivities with one exception, which was subject to much evaporation. Rainfall water showed higher conductivities than streams, and large variations, even during a single rainfall. The conductivities of later rains decreased relative to earlier rains, and convectional rains showed less variation than passing fronts. Runoff water passing through vegetation or cleared sites had higher conductivity than the rainfall water, indicating ions were added from the soil and plants, and this was accompanied by short-term fluctuations in the conductivities of small streams. Percolating water had lower conductivities, presumably due to loss of ions to the soil. Rainfall also had a high Ca to Na ratio and it was estimated that over a 2 month period it supplied the region with at least 4 kilograms of Ca per hectare. The probable sources of the ions in the rainwater are considered, and it is felt that wide spread burning during the dry season may be a major source because of the dispersion of large amounts of ash into the atmosphere. The hydrological cycle in the Mato Grosso probably effects a considerable amount of mineral recycling in plants and soils. (Casey-Arizona)
W70-08346

NUMERICAL SIMULATION OF WATERSHEDS USING PHYSICAL SOIL PARAMETERS,
Texas Univ., Austin; and Texas Tech Univ., Lubbock.
Walter L. Moore, and Bill J. Claborn.
13th Congress International Association for Hydraulic Research Proceedings, Vol 1, p 211-219, Aug-Sept 1969. 9 p, 4 fig, 9 ref.

Descriptors: Water resources development, Flow rates, Reservoirs, Soil moisture, Stream gages, *Streamflow records, Evapotranspiration, Digital computers, Simulation, Overland flow, *Watersheds (Basin), Hydrographs, *Runoff, Groundwater movement, Computer programs, Rainfall, Evaporation, Infiltration, Depression storage.
Identifiers: Stream gaging station, *Hydrologic models, Soil moisture movement, Pore size, *Stanford Watershed Model.

The best possible information on the amount and timing of streamflow is necessary for planning water resource developments. Limited information is available from stream gaging data, but information is needed at other points where no records, or records of very short duration, are available. Developing reliable and practical methods of hydraulic simulation offers one of the most promising methods for obtaining the necessary additional information. The advent of high-speed digital computers employing numerical models of the entire runoff process for a watershed has made hydrologic simulation feasible. One of the first and most successful simulation programs, the Stanford Watershed Model, is discussed. Revisions to the model have been made at the University of Texas at Austin to make the simulation of infiltration and soil moisture movement correspond more closely to the physical processes. In the modified model, the parameters representing the watershed are related to the physical quantities, and it is hoped that they can be related to measurable characteristics of the watershed. (USBR)
W70-08450

INDIRECT DETERMINATION OF SYNTHETIC RUNOFF,
Agricultural Research Service, Chickasha, Okla.
Donn G. DeCoursey, and Edward H. Seely.
13th Congress International Association Hydraulic Research Proceedings, Vol 1, p 123-131, Aug-Sept 1969. 9 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Synthetic hydrology, *Runoff, Runoff forecasting, Land use, Rainfall, *Rainfall-runoff relationships, Evaporation, Hydrology, Watershed management, Watersheds (Basins), *Mathematical models.
Identifiers: Stochastic models, Deterministic model, *Hydrologic models, Computer applications.

Synthetic sequences of daily storm runoff have been generated for a 1110-acre watershed in Texas. The system is used to generate the runoff and is composed of deterministic and stochastic elements. The watershed model--a function of land use, soil moisture, and evaporation--is deterministic in that a functional relationship exists between the inputs to the model and the model response. The model is not entirely deterministic because a probabilistic element fitted to the unexplained variance of the watershed response is included. Inputs to the system are stochastic and consist of daily rainfall and evaporation. A 2-state Markov chain of transition probabilities was used to calculate the occurrence or nonoccurrence of rainfall. The amount of rainfall was uncorrelated with previous rainfall or length of dry period. Monthly evaporation was correlated with the previous month's evaporation and present month's rainfall. Various statistical tests verified the adequacy of the methods used. Several synthetic sequences of runoff were generated with the watershed in 2 different land uses. The system can be used to study the relationship between land use, rainfall regime, length of record, and flood frequency. (USBR)
W70-08455

DESIGN FLOOD DETERMINATION IN SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
D. C. Midgley, R. A. Pullen, and W. V. Pitman.
Witwatersrand University Hydrological Research Unit Report No 4/69, December 1969. 66p, 34 fig, 38 tab, 8 append.

Descriptors: *Flood forecasting, *Flood routing, *Design flood, Rational formula, Routing, Time lag, Unit hydrographs, Rainfall-runoff relationships, Synthetic hydrology, Depth-area-duration analysis, Design storm.
Identifiers: *South Africa.

Design floods were calculated for most South African streams. For catchments up to about 5 square miles in area the conventional method of determining the peak discharge is by use of the Rational Formula. For determination of design output from catchments from 5 sq mi to about 2000 sq mi in area the unitgraph approach is recommended. Unitgraphs should not be synthesized for catchments larger than about 2000 sq mi. Although the design storm should be synthesized for the problem catchment as a whole, the catchment should then be subdivided into convenient subcatchments, none exceeding 2000 sq mi in area, and unitgraphs synthesized for each. Application of the appropriate parts of the effective design storm to these unitgraphs yields a flood hydrograph at the mouth of each sub-catchment. These separate flood hydrographs must then be lag-routed in turn to the problem site. (Knapp-USGS)
W70-08464

PRECIPITATION, STREAMFLOW, AND MAJOR FLOODS AT SELECTED SITES IN THE GILA RIVER DRAINAGE BASIN ABOVE COOLIDGE DAM, ARIZONA,
Geological Survey, Washington, D.C.
D. E. Burkham.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.50. US Geological Survey Professional Paper 655-B, 1970. 33 p, 23 fig, 5 tab,22 ref.

Descriptors: *Streamflow, *Rainfall-runoff relations, *Floods, *Arizona, Discharge (Water), Evapotranspiration, Phreatophytes, Surface waters, Climates, Precipitation (Atmospheric), Regime, Alluvial channels, Channel morphology.
Identifiers: Gila River Phreatophyte Project.

The Gila River Phreatophyte Project is a water-budget study to measure evapotranspiration from a 15-mile reach of the Gila River flood plain above Coolidge Dam in southeastern Arizona. Its principal purpose is to determine how much the water yield of the project area can be increased by replacing deep-rooted nonbeneficial woody plants with shallow-rooted beneficial grasses. There has been a fluctuating decline in annual precipitation and an almost continual decline in annual runoff since 1920. The decrease in precipitation has been mainly during the winter (November through April) and has resulted in a lower incidence of major floods. Major floods occurred in nine winters in the period 1891-1916, but only one major flood (December 1965) occurred in the period 1917-65. No significant progressive decrease has occurred in the ratio of runoff to a given amount of precipitation since 1920, nor has there been a progressive increase in the streamflow losses from the Gila River in Safford Valley. (Knapp-USGS)
W70-08468

GROUNDWATER - SURFACE WATER RELATION DURING PERIODS OF OVERLAND FLOW,
Geological Survey, Indianapolis, Ind.
For primary bibliographic entry see Field 02A.
W70-08488

MEANDERING OF THE ARKANSAS RIVER SINCE 1833 NEAR BENT'S OLD FORT, COLORADO,
Geological Survey, Denver, Colo.
Frank A. Swenson.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B210-B213, 1970. 4 p, 4 fig, 1 ref.

Descriptors: *History, *Meanders, *Alluvial channels, *Colorado, Erosion, Flood plains, Rivers, Surveys.
Identfiers: *Bent's Old Fort (Colo), *Arkansas River (Colo), National Historical Monuments.

Bent's Old Fort, constructed on the Santa Fe Trail in 1883 in southeastern Colorado, has been established as a National Historical Monument. The U.S. National Park Service is interested in determining the relative position of the fort, at the time it was occupied, to the meandering Arkansas River. Available data indicate there has been relatively little shift in the meanders of the river at this location. (Knapp-USGS)
W70-08490

TRENDS IN RUNOFF,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02B.
W70-08491

SYNTHETIC UNITGRAPHS FOR SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
P. A. Pullen.
Witwatersrand University Hydrological Research Unit Report No 3/69, December 1969. 201 p, 54 fig, 36 tab, 53 ref, 1 append.

Descriptors: *Unit hydrographs, *Routing, *Rainfall-runoff relationships, Duration curves, Depth-area-duration analysis, Hydrograph analysis, Synthetic hydrology, Data collections, Hydrologic data, Flood routing, Flood forecasting, Streamflow forecasting, Runoff forecasting.
Identifiers: *South Africa.

A method was developed for estimating the duration of excess rain and for deriving the unitgraph when the catchment rainfall that caused a significant flood rise is not measured. Nearly 600 flood events at 96 streamgages well spread over South Africa were analyzed by this method. Standard unitgraphs for each of the 96 selected catchments are compiled for a unitgraph library. Basin lags, estimated from the library unitgraphs, were correlated with physiographic characteristics represented in terms of a catchment index. South Africa was divided into nine zones displaying distinctive lag-physiography relationships. One-hour unitgraphs were derived from the library unitgraphs. Generalized dimensionless one-hour unitgraphs were calculated for each of the nine zones. Diagrams depicting the nine dimensionless one-hour unitgraphs are given as well as tabulations of the unitgraphs and the dimensionalizing parameters. (Knapp-USGS)
W70-08500

STRATIFIED RESERVOIR CURRENTS, PARTS 1 AND 2,
Oregon State Univ., Corvallis. Engineering Experiment Station.
For primary bibliographic entry see Field 02H.
W70-08501

QUANTITY AND CHEMICAL QUALITY OF LOW FLOW IN CIBOLO CREEK, TEXAS, MARCH 4-8, 1968,
Geological Survey, Austin, Tex.
William E. Reeves, and Harvey L. Kunze.
Texas Water Development Board Report 112, April 1970. 16 p, 3 fig, 3 tab, 4 ref.

Descriptors: *Low flow, *Water quality, *Texas, Sampling, Streamflow, Discharge (Water), Water chemistry, Water analysis, Data collections, Hydrologic data, Hydrogeology, Water pollution sources, Sewage, Sewage effluents.
Identifiers: Cibolo Creek (Tex).

The changes in quantity and inorganic chemical quality of base flow of Cibolo Creek, Texas, in the reach from the stream-gaging station at mile 89.6, downstream to a point 2.5 miles upstream from the mouth are described. The investigation was made during a period when evapotranspiration was at a minimum. Discharge increased in a downstream direction, from no flow at about mile 88 to 67.4 cfs at mile 2.5. Dissolved-solids concentrations also increased in a downstream direction throughout the reach. (Knapp-USGS)
W70-08509

QUANTITATIVE MORPHOLOGY OF THE DRAINAGE BASIN IN SEMI-ARID ENVIRONMENT,
Central Arid Zone Research Inst., Jodhpur (India).
Bimal Ghose, S. Pandey, and S. Singh.
Annals of Arid Zone, Vol 8, No 1, p 37-44, March 1969. 14 fig, 4 tab, 7 ref.

Descriptors: *Streams, *Basins, *Geologic mapping, *Lithification, Geological surveys, Arid lands, Geomorphology, Hydrogeology, Drainage density, Channel morphology.
Identifiers: *Bifurcation ratio, *Stream order, *India, *Rajasthan desert, *Drainage basins, Stream gradient, Relief ratio, Constant channel maintenance, Stream frequency, Basin order.

Twelve drainage basins in a semi-arid areas were randomly selected and studied using aerial maps. The basins were divided into 3 lithological groups - granite, phyllite-schist-quartzite, and sandy older alluvium. Fourteen geomorphic characteristics were determined for each group. A line drawing of the topography of each basin is included. The number of streams in a given basin decrease with increase in stream order; main stream length increases with increase in stream order. However the total lengths of each order are inversely related to the order. Stream length ratios did not vary with lithology but basin area ratios did. The average values of most of the geomorphic characteristics did vary with lithology. (Casey-Arizona)
W70-08526

ROUTING MODIFICATIONS TO SUBURBAN DESIGN HYDROGRAPHS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W70-08540

2F. Groundwater

GRAVITY INVESTIGATION OF THE WATER-BEARING STRATA IN SWAN VALLEY, MONTANA,
Montana Univ., Missoula; and Montana Water Resources Research Center, Bozeman.
Gary W. Crosby.
Completion Report, (1970). 2p. OWRR A-023-MONT (1).

Descriptors: *Gravity studies, *Groundwater, Water-bearing strata, Montana.
Identifiers: Swan Valley (Montana).

The Swan Valley and contiguous portions of the Swan and Mission Ranges have been covered with 325 gravity stations for a spacing density of one measurement per 1.25 sq. mi. Gravity data have been processed through the computer and their Bouguer anomalies have been calculated and plotted. There is considerable irregularity in the gravity field, particularly at the south end. Inferring an average porosity of 18 per cent from density data, there are 27 cubic miles of pore space. If a specific yield of 0.5 is assumed, there are 46,700,000 acre-feet recoverable, or about 1.2 X 10 to the 13th power gallons that may be produced. It is believed that these figures are conservative. (Holje-University of Montana)
W70-08149

AEROMAGNETIC, GRAVITY, AND ELECTRICAL RESISTIVITY EXPLORATION BETWEEN PAHALA AND PUNALUU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 07C.
W70-08154

AN EXAMPLE OF THE STUDY OF ISOTOPIC HYDROLOGY IN A SEMI-ARID REGION, THE BASIN OF LAKE CHAD (IN FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France); United Nations Educational, Scientific and Cultural Organization, Paris (France). Office of Hydrology; and Groningen Rijksuniversiteit (Netherlands). Natuurkundig Laboratorium.
For primary bibliographic entry see Field 02K.
W70-08177

USE OF GROUNDWATER FOR IRRIGATION, SEWARD COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 04B.
W70-08179

GEOLOGY AND GROUNDWATER RESOURCES OF SALEM COUNTY, NEW JERSEY,
Geological Survey, Trenton, N.J.
Jack C. Rosenau, Solomon M. Lang, George S. Hilton, and James G. Rooney.
New Jersey Division Water Policy and Supply Special Report No 33, 1969. 142 p, 21 fig, 7 tab, 25 ref, append.

Descriptors: *Water resources, *Groundwater, *Aquifers, *Saline water intrusion, *New Jersey, Water supply Withdrawal, Water yield, Water quality, Surveys, Water levels, Water utilization, Geology, Hydrologic data, Data collections, Hydrogeology.
Identifiers: Salem County (N J).

The Potomac Group and Raritan and Magothy Formations contain the most productive aquifers in Salem County, N.J. These aquifers are hydraulically connected and form a single hydrologic unit or aquifer system. Reported yields of wells tapping this system range up to 860 gpm. The highest yields commonly occur near the Delaware River. A decline in water levels resulted from heavy pumpage, and has created the danger of salt-water encroachment into the aquifer from downdip areas where the aquifer already contains saline water. Local chloride concentrations are as high as 2,057 ppm. Use of groundwater in Salem County in 1964 averaged 12.28 mgd or nearly 200 gpd per person. Industrial use was 5.33 mgd and use for public supply was 2.74 mgd. Irrigation, which has become increasingly important in recent years accounted for 2.14 mgd. Average total summer use of groundwater---approximately 17.7 mgd---was considerably higher than the yearly average. (Knapp-USGS)
W70-08198

A CONCEPTUAL MODEL OF THE GROUNDWATER REGIME AND THE HYDROGEOLOGIC ENVIRONMENT,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 02A.
W70-08208

BLOTTING PAPER MODELS SIMULATING GROUNDWATER FLOW,
Agricultural Univ., Wageningen (Netherlands).
R. J. Sevenhuysen.
Journal of Hydrology, Vol 10, No 3, p 276-281, Apr 1970. 6 p, 5 fig.

Descriptors: *Groundwater movement, *Hydraulic models, Model studies, Soil water movement, Infiltration, Saturated flow, Leaching.
Identifiers: Blotting paper models.

To demonstrate water flow in a cross-sectional model, use can be made of a heavy blotting paper. This material is easily cut into any shape, lines can be drawn on it, and samples can be taken out. The sheets of blotting paper, forming the model, are hung vertically, the flow is introduced by saturated sheets placed vertically or horizontally as required. Simulation of infiltration, saturated flow and leaching is described. (Knapp-USGS)
W70-08213

A MARYLAND COASTAL AQUIFER,
Maryland State Geological Survey, Baltimore.
For primary bibliographic entry see Field 02L.
W70-08227

CRITICAL EVALUATION OF CERTAIN METHODS OF UNSTEADY GROUNDWATER HYDRAULICS,
Wisconsin Univ., Milwaukee; and Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
Gabor M. Karadi, Raymond J. Krizek, and Manual Rechea.
Water Resources Bulletin, Vol 6, No 3, p 424-438, May-June 1970. 15 p, 8 fig, 13 ref.

Descriptors: *Groundwater movement, *Hydrogeology, *Unsteady flow, *Mathematical studies, *Reviews, Equations, Darcys law, *Analytical techniques, Dupuit-Forchheimer theory, Steady flow, Laplaces equation, Numerical analysis.
Identifiers: Unsteady groundwater flow.

The basic theories and fundamental assumptions usually employed in the solution of unsteady groundwater flow problems are reviewed critically. The best known method of analysis for such problems is based on the Dupuit-Forchheimer approximation and leads to a nonlinear parabolic differential equation which is generally solved by linerization or numerical methods. The accuracy of the solution to this equation can be improved by use of a different approach which does not employ the Dupuit-Forchheimer assumption, but rather is based on a seminumerical solution of the Laplace equation for quasi-steady conditions. The actual unsteady process is replaced by a sequence of steady-state conditions, and it is assumed that the actual unsteady flow characteristics during a short time interval can be approximated by those associated with 'average' steady state flow. The Laplace equation is solved by a semidiscretization method according to which the horizontal coordinate is divided into subintervals, while the vertical coordinate is maintained continuously. The proposed method is applied to a typical tile drainage problem, and, based on a comparison of calculated results with experimental data, the method is evaluated and practical conclusions regarding its applicability are advanced. (Knapp-USGS)
W70-08230

STATISTICAL ANALYSIS OF GROUNDWATER USE AND REPLENISHMENT,
Missouri Univ., Rolla. Dept. of Geological Engineering; and Colorado State Univ., Ft. Collins. Dept. of Geology.
For primary bibliographic entry see Field 04B.
W70-08231

THE HYDROGEOLOGIC PARAMETER MU AND A METHOD FOR COMPUTING GROUNDWATER STORAGE,
Akademiya Nauk SSSR. Institut Geologii.
For primary bibliographic entry see Field 07B.
W70-08266

THE THEORY OF GROUNDWATER MOTION AND RELATED PAPERS,
M. King Hubbert.
New York, NY, Hafner Publishing Co, Inc, 1969. 310 p, 103 fig.

Descriptors: *Darcys law, *Groundwater movement, Porous media, Hydraulic conductivity, Laplaces equation, Mathematical studies, Percolation, Potential flow, Saturated flow, Theis equation, Thiems equation, Hydrodynamics.
Identifiers: Groundwater flow laws.

Groundwater movement is discussed in a reprint collection of four papers including Darcy's paper of 1856 in which Darcy's law was first published. The papers are: The Theory of Groundwater Motion (1940), Entrapment of Petroleum under Hydrodynamic Conditions (1953), Darcy's Law and the Field Equations of the Flow of Underground Fluids (1957), by M. K. Hubbert; and Determination des lois d'ecoulement de l'eau a travers le sable (1856) by Henry Darcy. Some errors in the earlier versions of the papers were corrected. (Knapp-USGS)
W70-08279

WATER RESOURCES OF THE ARID LANDS,
Aberdeen Univ. (Scotland).
For primary bibliographic entry see Field 04B.
W70-08351

STATUS AND TRENDS IN LOGGING,
Marathon Oil Co., Littleton, Colo.
For primary bibliographic entry see Field 08E.
W70-08446

HYDROGEOLOGY OF THE UPPER SILVER BOW CREEK DRAINAGE AREA, MONTANA,
Montana Bureau of Mines and Geology, Butte.
Maxwell K. Botz.
Available from the Clearinghouse as PB-193 025, $0.65 in microfiche; paper copy available from Montana Bureau of Mines and Geology, Butte, $0.35. Montana Bureau of Mines and Geology Bulletin 75, September 1969. 32 p, 6 fig, 10 tab, 2 plate, 22 ref. OWRR A-012 MONT (1).

Descriptors: *Water resources, *Groundwater, *Hydrogeology, *Montana, Alluvium, Aquifers, Water supply, Water yield, Water quality, Recharge water, Groundwater movement.
Identifiers: Silver Bow Creek (Montana).

Geologically, the Upper Silver Bow Basin, Montana is entirely within the Boulder batholith. Granitic rocks and alluvium derived from their weathering are, by far, the most abundant geological materials in the area. A 23 square mile alluvial filled valley south of Butte is the principal aquifer in the area. Alluvium in most of the area will yield sufficient water for domestic and stock use and in selected areas will yield several hundred gallons per minute to wells. Fractured rock in many places yields sufficient water for domestic and stock use. Streams entering the alluvial valley are the principal source of groundwater recharge. About 440,000 acre-feet of groundwater is in storage within the upper 200 feet of saturated alluvium. Movement of groundwater in the alluvial aquifer is northward at a gradient of about 15 feet per mile. There has been little net change in the configuration of the water table in the last 55 years. Scattered data indicate little annual fluctuation of the water table. Water quality is generally good; and the water is of the calcium bicarbonate type. (Botz-Montana)
W70-08463

THE RAFT RIVER BASIN, IDAHO-UTAH, AS OF 1966: A REAPPRAISAL OF THE WATER RESOURCES AND EFFECTS OF GROUNDWATER DEVELOPMENT,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 04B.
W70-08466

RECORDS OF WATER LEVELS AND CHEMICAL ANALYSES FROM SELECTED WELLS IN PARTS OF THE TRANS-PECOS REGION, TEXAS, 1965-68,
Geological Survey, Austin, Tex.
M. E. Davis, and J. D. Gordon.
Texas Water Development Board Report 114, April 1970. 49 p, 9 fig, 7 tab, 11 ref.

Descriptors: *Groundwater, *Texas, *Hydrologic data, *Water levels, *Water quality, Water yield, Saline water, Irrigation water, Salinity, Water chemistry, Water yield, Data collections, Leaching, Infiltration, Percolation.
Identifiers: Trans-Pecos region (Tex).

Current information on water levels and the chemical quality of water in selected wells in the Trans-Pecos area of Texas is presented. Much of the information was collected in the heavily developed Salt basin and is particularly useful in evaluating the effects of large scale groundwater development. A substantial part of groundwater pumped in the area is for irrigation, most of which is in the Salt basin. On the basis of acreage irrigation, pumping rates, power tests, and records of fuel consumption, about 128,000 acre-feet of water was pumped in the Salt basin in 1967. Of this amount, 105,000 acre-feet was pumped in the Dell City subarea. In general, the quality of groundwater within the Salt basin becomes increasingly more mineralized northward. In the Lobo Flats-Chispa subarea, the

water is low in dissolved solids but high in percent sodium, a condition that has reduced the permeability of the subsoil. The concentration of dissolved solids in the more heavily pumped part of the Dell City subarea now ranges from at least 1,550 mg/l to more than 6,000 mg/l. The water is usable for irrigation, however, largely because of the high permeability of the soils. (Knapp-USGS)
W70-08480

TRANSMISSIVITY AND STORAGE COEFFICIENT OF AQUIFERS IN THE FOX HILLS SANDSTONE AND THE HELL CREEK FORMATION, MERCER AND OLIVER COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, N. Dak.
Mack G. Croft, and E. A. Wesolowski.
For sale by the Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B190-B195, 1970. 6 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Transmissivity, *Storage coefficient, *Aquifers, *North Dakota, Water resources, Stock water, Water wells, Artesian wells, Hydrogeology, Water yield, Permeability, Discharge (Water).
Identifiers: Mercer County (ND), Oliver County (ND), Fox Hills Sandstone, Hell Creek Formation.

Since 1963, about 100 flowing stock and domestic wells have been drilled into the Fox Hills Sandstone and the Hell Creek Formation in Mercer and Oliver Counties, N. Dak. Aquifer tests were made on about half of the wells. The values obtained for transmissivity range from 13 to 3,100 gallons per day per foot, and average 510 gallons per day per foot. An analysis of the potentiometric surface in the southwestern part of Mercer County indicates a transmissivity of about 1,400 gallons per day per foot. The values for permeability average 16 gallons per day per square foot. Data indicate storage coefficient values are between 0.0001 and 0.00001. The aquifer tests indicate that the wells have specific capacities that range from less than 0.1 to 0.6 gallon per minute per foot. (Knapp-USGS)
W70-08485

PRELIMINARY ANALYSIS OF RATE OF MOVEMENT OF STORM RUNOFF THROUGH THE ZONE OF AERATION BENEATH A RECHARGE BASIN ON LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
G. E. Seaburn.
For sale by the Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B196-B198, 1970. 3 p, 3 fig, 1 tab, 2 ref.

Descriptors: *Artificial recharge, *Unsaturated flow, *Infiltration, *New York, Soil water movement, Groundwater movement, Storm runoff, Urbanization, Cities, Pit recharge.
Identifiers: Long Island (NY).

A study of recharge basins on Long Island has provided information on the rate of movement of water through the zone of aeration. Pertinent data were collected during 38 storms from a basin in central Nassau County, where the depth to the water table is 35 feet below the bottom of the basin. In this basin the apparent downward rate of movement averaged 5.0 feet per hour; it ranged from an average of 3.0 feet per hour for storms in November through March to an average of 6.0 feet per hour for storms in April through October. (Knapp-USGS)
W70-08486

GROUNDWATER INFLOW TOWARD JORDAN VALLEY FROM UTAH VALLEY THROUGH VALLEY FILL NEAR THE JORDAN NARROWS, UTAH,
Geological Survey, Salt Lake City, Utah.
R. W. Mower.
For sale by the Superintendent of Documents US Government Printing Office, Washington, D.C. 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B199-B202, 1970. 4 p, 3 fig, 4 ref.

Descriptors: *Groundwater movement, *Alluvium, *Aquifers, *Utah, Hydraulic conductivity, Permeability, Transmissivity, Water levels, Surveys, Seismic studies, Electrical resistance, Geophysics, Investigations.
Identifiers: Valley-fill alluvium, Utah Valley.

About 2,500 acre-feet of groundwater annually is moving generally northward from Utah Valley toward Jordan Valley through unconsolidated valley fill near the Jordan Narrows, Utah. The computation of underflow was made at a section in which the saturated fill averages about 125 feet in thickness and is between 2,700 and 4,000 feet wide. The fill consists of sediments ranging from clay to coarse gravel in size, and it has an average hydraulic conductivity of about 3,200 cubic feet per day per square foot. Underlying and bounding the fill on the east and west sides of the narrows are semiconsolidated or consolidated rocks of low average hydraulic conductivity through which there is little underflow. (Knapp-USGS)
W70-08487

GROUNDWATER - SURFACE WATER RELATION DURING PERIODS OF OVERLAND FLOW,
Geological Survey, Indianapolis, Ind.
For primary bibliographic entry see Field 02A.
W70-08488

WATERBORNE STYRENE IN A CRYSTALLINE BEDROCK AQUIFER IN THE GALES FERRY AREA, LEDYARD, SOUTHEASTERN CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 05B.
W70-08489

THE RELATIONSHIP BETWEEN SURFACE WATER AND GROUNDWATER IN SHIP CREEK NEAR ANCHORAGE, ALASKA,
Geological Survey, Anchorage, Alaska.
John B. Weeks.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B224-B226. 3 p, 3 fig, 1 tab, 4 ref.

Descriptors: *Surface-groundwater relationships, *Recharge, *Aquifers, *Alaska, Alluvial channels, Glacial drift, Alluvium, Groundwater basins, Bank storage, Base flow, Discharge (Water), Seepage.
Identifiers: Anchorage (Alaska).

Ship Creek drainage basin is an important recharge area for the Anchorage artesian aquifer. Discharge records show Ship Creek loses an average of 25 cfs in the recharging area and gains about 22 cfs in the reach below the recharge area. A water-budget analysis demonstrates that of this gain at least 11 cfs is groundwater return flow from the recharge area. (Knapp-USGS)
W70-08492

PRAIRIE POTHOLES AND THE WATER TABLE,
Geological Survey, Denver, Colo.
C. E. Sloan.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B227-B231, 1970. 5 p, 6 fig, 1 tab, 3 ref.

Descriptors: *Surface-groundwater relationships, *Potholes, *Grasslands, *Water table, *Water level fluctuations, Water quality, Aquifers, Groundwater movement, North Dakota, Glacial drift, Lakes.
Identifiers: Prairie Potholes.

Prairie potholes, or sloughs, are water-holding depressions of glacial origin that occur in the prairies of the northern conterminous United States and southern Canada. The water table in the prairie-pothole region is a shallow surface that is a subdued image of the general topography. In detail, however, small variations in topography are not reflected, and in cross sections the water table is almost a straight line linking pothole water surfaces. Salinity and permanence of contained water differ widely among potholes and are influenced by groundwater flow which, in turn, is partially dependent on the configuration of the water table surrounding the pothole. Groundwater inflow, throughflow, and outflow result when the adjacent water table is correspondingly high, intermediate, and low. Relative permanence and salinity increase or decrease as net groundwater movement ranges from inflow to outflow. (Knapp-USGS)
W70-08493

2G. Water in Soils

USING SOIL MAPS TO DELINEATE FLOODPLAINS IN A GLACIATED LOW-RELIEF LANDSCAPE,
Wisconsin Univ., Madison. Dept. of Soil Science.
Dale E. Parker, Gerhard B. Lee, and Douglas A. Yanggen.
Journal of Soil and Water Conservation, Vol 25, No 3, p 96-99, May-June 1970. 4 p, 3 fig, 2 tab, 6 ref.

Descriptors: *Mapping, *Flood plains, *Aerial photography, *Soil surveys, Floods, Drainage, Soil water, Alluvium, Soil types, Soil investigations, Soil-water-plant relationships.
Identifiers: Flood plain mapping.

Floodplain boundaries determined by engineering methods were superimposed on detailed soil maps along two reaches of the Root River watershed in southeastern Wisconsin. A comparison of the predicted flood boundaries with soil boundaries showed that alluvial soils are subject to frequent flooding. In addition, other soils adjacent to or connected with the alluvial bottomlands were susceptible to flooding in varying degrees. The most poorly drained soils were, in general, the most likely to flood. (Knapp-USGS)
W70-08183

EFFECT OF ANTECEDENT SOIL WATER ON PRESEASON RAINFALL STORAGE IN A SLOWLY PERMEABLE IRRIGATED SOIL,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
J. T. Musick.
Journal of Soil and Water Conservation, Vol 25, No 3, p 99-101, May-June, 1970. 3 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Infiltration, *Water storage, *Soil water, *Antecedent precipitation, Rain-fall-runoff relationships, Permeability, Irrigation, Texas, Water levels, Storage coefficient, Soil-water-plant relationships, Water conservation.
Identifiers: Antecedent soil water.

Preseason rainfall storage declined from the 30-percent to 50-percent level when the soil profile was dry after harvest to less than 10 percent when the soil was wet. This emphasizes the importance of an early irrigation cutoff date (not later than early grain filling) to largely deplete soil moisture before

harvest and provide storage capacity for expected preseason rainfall in the Southern High Plains, Texas. (Knapp-USGS)
W70-08184

EVAPOTRANSPIRATION MEASUREMENT BY CHLORIDE TRANSLOCATION,
Agricultural Research Service, Reno, Nev. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02D.
W70-08210

WATER QUALITY EFFECTS OF LEACHING FROM SUBMERGED SOILS,
National Field Investigations Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05B.
W70-08218

EVALUATION OF THE INTRINSIC-PENETRABILITY AND -DIFFUSIVITY CONCEPTS TO PREDICT HORIZONTAL INFILTRATION IN POROUS MEDIA,
California Univ., Riverside. Department of Soils and Plant Nutrition.
M. A. Mustafa, J. Letey, and C. L. Watson.
Soil Science Society of America Proceedings, Vol 34, No 3, p 369-372, May-June 1970. 4 p, 5 fig, 2 tab, 16 ref.

Descriptors: *Soil water movement, *Diffusivity, *Infiltration, *Wettability, Surface tension, Organic matter, Surfactants, Wetting, Laboratory tests, Organic compounds, Viscosity.
Identifiers: *Water-repellent soils.

Horizontal infiltration of nine organic liquids and 0.01N calcium sulfate into glass beads and wettable and water-repellent soils was conducted to study the concepts of intrinsic penetrability and diffusivity. The concepts were found to apply to the two wettable porous media and all liquids considered. The concepts apply to the organic liquids but not to the 0.01N calcium sulfate in the water-repellent medium. (Knapp-USGS)
W70-08219

MEASUREMENT OF THE TOTAL SUCTION OF SOILS BY A THERMISTOR PSYCHROMETER,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
B. D. Kay, and Philip F. Low.
Soil Science Society of America Proceedings, Vol 34, No 3, p 373-376, May-June 1970. 4 p, 5 fig, 15 ref.

Descriptors: *Soil moisture meters, *Temperature, *Humidity, *Vapor pressure, Instrumentation, Osmosis, Thermodynamics, Osmotic pressure, Calibrations, Clays, Soils.
Identifiers: *Thermistor physchrometer.

A detailed description of a thermistor psychrometer is presented. The psychrometer depends on differential cooling due to unequal evaporation rates of water droplets suspended from matched thermistors which are located above the sample and reference. The resulting difference in resistance between the thermistors is measured by a Wheatstone bridge and referred to a calibration curve for the determination of the total suction of the sample. Results obtained by the psychrometer on a Brookston silt loam are shown to agree with those obtained by a pressure plate. However, results obtained by the phychrometer on a pure clay-water system are shown to differ from those obtained by a tensiometer. A possible reason for this difference is given. (Knapp-USGS)
W70-08220

ANALYSIS OF RADIAL, STEADY-STATE SOLUTION, AND SOLUTE FLOW,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.; and Illinois Univ., Urbana. Dept. of Soil Physics.
Frank D. Whisler, Arnold Klute, and Richard J. Millington.
Soil Science Society of America Proceedings, Vol 34, No 3, p 382-387, May-June 1970. 6 p, 13 fig, 15 ref.

Descriptors: *Soil water movement, *Root zone, Diffusion, Soil-water-plant relationships, Hydraulic conductivity, Soil moisture, Moisture tension, Moisture uptake.
Identifiers: Flow to roots, Radial flow.

Equations which describe steady-state solution and solute flow to a root were solved in a seminumerical-analytical manner subject to fixed tensions and concentrations at the inner and outer radial boundaries. Tension, solution content, and solute concentration profiles are shown for conductivity and diffusion coefficients which vary with saturation. Fluxes of solution and solute are calculated for several boundary conditions. Limiting solution fluxes are predicted. (Knapp-USGS)
W70-08221

PREDICTING MOISTURE DISTRIBUTIONS IN REWETTED SOILS,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
W. J. Staple.
Soil Science Society of America Proceedings, Vol 34, No 3, p 387-392, May-June 1970. 6 p, 8 fig, 14 ref.

Descriptors: *Infiltration, *Percolation, *Wetting, *Hysteresis, *Soil water movement, Hydraulic conductivity, Unsaturated flow, Soaking, Diffusivity, Drying, Laboratory tests, Capillary action, Soil physical properties.
Identifiers: Soil rewetting.

Computed and measured soil moisture distributions were compared during second and third cycles of infiltration and redistribution. In order to obtain acceptable agreement, the hydraulic conductivity had to be reduced to about one-half of the value used in the first cycle for freshly packed soil. One method was to correct the conductivity by trial and error. The other was to measure the conductivity of the soil after it had been carried through an initial wetting and drying cycle. Hysteretic effects on rewetting were minimized by adding sufficient water to the partially dried soil to bring it back to its initial wetted condition. The independent domain theory was found satisfactory for providing wetting tension data during the brief infiltration period. Modified tension scanning curves for drying were used in second-cycle computations for clay soil but the original curves for freshly packed columns were used for sand. (Knapp-USGS)
W70-08222

HYDRAULIC CONDUCTIVITY OF AN ISOTROPICALLY COMPRESSED SOIL,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition; Geological Survey, Menlo Park, Calif; and Oregon State Univ., Corvallis.
L. J. Waldron, J. L. McMurdie, and J. A. Vomocil.
Soil Science Society of America Proceeding, Vol 34, No 3, p 393-396, May-June 1970. 4 p, 4 fig, 10 ref.

Descriptors: *Hydraulic conductivity, *Soil compaction, *Stress, *Soil physics, Electrolytes, Soil water movement, Laboratory tests, Porosity.
Identifiers: Confining pressure (Soils).

Hydraulic conductivities (K) of disturbed samples of Yolo loam were measured under isotropic confining pressures of from 0.1 to 3.2 kgm/sq cm in a triaxial test cell. Solutions of 1,10, and 100 meq/liter of NaCl or calcium chloride produced marked differences in K, slight effects on compressibility, and no effect on soil dispersibility. The Kozeny-Carman equation showed the same pattern of failure reported for clays and soils compressed anisotropically, in that K declined much more with decreasing porosity than predicted. Hypothetical K versus depth profiles calculated from K versus confining pressure data support a hypothesis that the K decreases with depth reported in texturally homogeneous soils may be attributable to overburden pressure. (Knapp-USGS)
W70-08223

WATER RELATIONS OF A PROFILE-MODIFIED SLOWLY PERMEABLE SOIL,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
For primary bibliographic entry see Field 04B.
W70-08224

SOIL MOISTURE TENSION TRANSIENTS ASSOCIATED WITH EVAPOTRANSPIRATION FROM A WATER TABLE,
Agricultural Research Service, Fresno, Calif. Field Station.
For primary bibliographic entry see Field 02D.
W70-08225

WATER PERMEABILITY OF FROZEN SOILS IN THE CENTRAL CHERNOZEM PROVINCE,
G. B. Nazarov.
Transl from (Izvestiya VGO), Vol 101, No 3, p 218-224, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 79-84, 1969. 6 p, 4 fig, 6 tab, 3 ref.

Descriptors: *Permeability, *Chernozems, *Frozen ground, *Cultivation, Frost, Infiltration, Soil water movement, Lysimeters, Cultivated lands, Grasslands, Forests, Land management, Runoff.
Identifiers: USSR.

The water permeability of frozen soils was studied for 3 years on the runoff plots of the Kursk Forest-Steppe Station of the USSR. The regional soils investigated are thick clay loam chernozems. The experiments were made by the method of flooded rings which were driven into the soil to a depth of 10-15 cm. Water absorption is fairly uniform under stubble, under winter crops, and on virgin land in various parts of the same field both in thawed and frozen soils. Under natural vegetation absorption and filtration depend little on the depth of the thawed soil layer because soil under natural vegetation is more porous as a result of the prolonged effect of root systems and burrowing animals. In fields, the soil is loosened annually during fall plowing and harrowing, but it is compacted by agricultural machines during sowing and harvesting. At the depth of the plow sole (20-25 cm) the soil is compacted by plowshares. Furthermore, at the surface of the plow sole, a large amount of silt and clay is washed in from the overlying loosened soil horizons. Rains also have a considerable compacting effect on plowed fields. Under natural vegetation the soil is protected from the impact of rain drops by the plant mat and in the forest by the litter. (Knapp-USGS)
W70-08272

COMPUTATION OF THE DESALINIZATION OF SALINE SOILS UNDERLAIN BY A WATER-PERMEABLE LAYER,
R. V. Savel'yeva, and V. A. Baron.
Transl from Izvestiya Akad nauk Uzb SSR, ser. tekh nauk No 3, p 39-43, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 94-98, 1969. 5 p, 1 fig, 7 ref.

Descriptors: *Saline soils, *Leaching, *Land management, Diffusion, Ion transport, Mass transfer, Groundwater movement, Soil water movement, Permeability, Heat transfer, Convection, Salinity, Water quality, Soil chemical properties.
Identifiers: *Soil desalination, USSR.

The salt regime of soil water forms under the effect of molecular diffusion, sorption, filtration, and thermal and pressure diffusion. The gradients of thermal and pressure diffusion are 4-5 orders of magnitude lower than the gradients of the concentration of matter. Knowing the initial salinization

profile, the leaching rate (magnitude of filtration flow), porosity, the coefficient of convective diffusion, the thickness of the fine-earth mantle, and salt concentration of the leaching water, the salt regime of soils may be calculated. (Knapp-USGS)
W70-08274

RELATIONSHIPS BETWEEN CERTAIN INDICES OF SALINE WATER IRRIGATED SOILS OF WESTERN RAJASTHAN,
Central Arid Zone Research Inst., Jodhpur (India); and Indian Grassland and Fodder Research Inst., Jhansi (India). Div. of Soil Science and Agronomy.
I. C. Gupta, R. K. Bohra, and C. T. Abichandani.
Annals of Arid Zone, Vol 8, No 1, p 27-32, March 1969. 5 tab, 7 ref.

Descriptors: *Saline soils, *Conductivity, *Sodium, *Cations, *Anions, Soil properties, Arid lands, Salts, Soil chemical properties, Soil texture, Alkalinity, Irrigation effects, Soil science, Correlation analysis, Regression analysis.
Identifiers: *India, *Rajasthan desert, *Saturation percentage.

In efforts to appraise soil salinity problems for reclamation efforts, it is important to know the values of electrical conductivity of saturation extracts, EC (e), total soluble cations (TCC.) and soluble Na concentration (SSC). Analytical procedures for obtaining these values are time-consuming, and inter-relationships between the various parameters vary considerably with locale. Fifty-six soil samples of varying saline and sodic conditions were collected in plots irrigated with saline water from different areas of western Rajasthan. The conductivities of 1:2 soil-water suspension, EC (2), were measured with and without known saturation percentage (SP). Analytical procedures allowing determination of EC (e), SSC, and TTC were also performed. Simple correlation coefficients were calculated between EC (2) and EC (e), TTC, and SSC, and also multiple correlation coefficients between EC (2) and EC (e) and SP, TTC and SP, and SSC and SP. Corresponding simple linear and multiple regression equations were then determined. It was concluded that EC (2) is a highly accurate predictor of the crucial parameters of EC (e), TTC, and SSC, and inclusion of known SP improves it predictability. (Casey-Arizona)
W70-08347

IMPORTANT PHYSICAL PROPERTIES OF PEAT MATERIALS,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
D. H. Boelter.
Proceedings Third International Peat Congress, Quebec, Canada, 1968, p 150-154.

Descriptors: *Peat, *Organic soils, *Water storage, *Soil density, *Soil water, *Hydraulic conductivity, *Soil physical properties, Bogs, Minnesota, Soil mositure, Soil water movement, Hydrologic properties, Retention, Porosity.
Identifiers: *Fiber content, Degree of decomposition, *Histosols, Water yield coefficient, *Bulk density

Peat materials from 12 bogs in northern Minnesota, U.S.A., showed significant differences in physical properties. It is pointed out that (a) these properties can be related to the hydrology of organic soils only if the soils represent undisturbed field conditions, and (b) volumetric expressions of water content are necessary to correctly evaluate the amount of water in a peat profile. The differences in physical properties were related to degree of decomposition as measured by bulk density and fibre content. Undecomposed peats with low bulk density and high fibre content contain many large pores which yield as much as 80 percent of their saturated water content to drainage and permit rapid water movement. With increasing decomposition, fibre content decreases, resulting in increased bulk density and a greater proportion of small pores. The most decomposed peats yield less than 10 percent of their water to drainage and have very slow water movement rates.
W70-08424

THE HYDROLOGY OF SEVERAL PEAT DEPOSITS IN NORTHERN MINNESOTA, U.S.A.,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
R. R. Bay.
Proceedings Third International Peat Congress, Quebec, Canada, 1968, p 212-218.

Descriptors: *Peat, *Organic soils, *Bogs, *Runoff, Minnesota, Swamps, Groundwater, Water table, Streamflow, Small watersheds, Forestry.
Identifiers: *Peatlands, *Wetland hydrology, *Experimental watersheds, Bog watersheds.

A comprehensive peatland hydrology study has provided data on the climate, hydrogeology, water table levels, and run-off from forested peat deposits in northern Minnesota. Groundwater studies identified two types of hydrogeologic situations--perched bogs, independent of the underground flow system, and groundwater bogs, which were influenced by storage changes in the surrounding groundwater basin. Bog water table levels indicated storage opportunity in the peat deposit, and their reaction to precipitation was influenced in part by the type of peat material in the zone of active fluctuation. Bog run-off was not evenly distributed. Most of the annual water yield occurred in spring before June 1, while summer and fall water yields were generally low. Run-off was directly related to water table elevation in the peat deposits.
W70-08425

SOIL WATER USE FROM AN APPLE ORCHARD UNDER VARIOUS SOIL MANAGEMENT SYSTEMS,
Department of Agriculture, Ferntree Gully, (Victoria). Scores by Horticultural Research Station.
For primary bibliographic entry see Field 03F.
W70-08428

DISTORTION TESTS ON DRAINED NATURAL CLAY SAMPLES,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
J. D. Nieuwenhuis.
LGM Mededelingen, Delft Laboratoriumvoor Grondmechanica) Deel 13, No 4, p 147-184, April 1970. 38 p, 22 fig, 3 ref, 3 append.

Descriptors: *Clays, *Soil physical properties, *Deformation, Soil mechanics, Compressive strength, Consolidation, Soil compaction, Soil strength, Laboratory tests, Hysteresis, Stress analysis, Strength of materials, Shear strength, Tensile strength, Testing.
Identifiers: Clay mechanical properties.

Results obtained from distortion tests on natural clay samples are presented. The traditional cell test is compared with compression-distortion tests. The few modifications of the cell apparatus necessary to allow the execution of compression-distortion tests are described. A program of tests was designed to investigate the properties of the shear modulus G of drained samples. The samples were subjected to variations in isotropic stress, deviator stress and deviator stress rate. G appeared to be variable, but its reproduction is satisfactory. The influence of isotropic stresss is very small. G is largely determined by the deviator stresses. The hysteresis loop changes if larger maximum deviator stresses are applied. Time effects are reflected in the shear modulus, since clay soils creep (continued deformation under constant load). An empirical estimate of time effects is presented. (Knapp-USGS)
W70-08481

PRELIMINARY ANALYSIS OF RATE OF MOVEMENT OF STORM RUNOFF THROUGH THE ZONE OF AERATION BENEATH A RECHARGE BASIN ON LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 02F.
W70-08486

SOIL MICROBIAL ECOLOGY OF VALLEY OF 10,000 SMOKES, ALASKA,
Jet Propulsion Lab., Pasadena, Calif.
Roy E. Cameron.
Journal of the Arizona Academy of Science, Vol 6, No 1, p 11-40, March 1970. 14 fig, 15 tab, 76 ref.

Descriptors: *Alaska, *Soil microorganisms, *Soil physical properties, *Soil chemical properties, *Soil water, Soil texture, Soil types, Soil algae, Soil bacteria, Soil erosion, Soil stability, Soil water movement, Soil temperature, Mosses, Winds, Wind erosion, Porosity, Acidic soils, Conductivity, Soil types, Bulk density, Specific gravity, Osmotic pressure, On-site investigations.
Identifiers: *Liverworts, *Extraterrestrial biology, *Harsh environments, *Water retention, Available water, Macrovegetation, Soil air, Extractable ions, Reflectivity ratios.

Surveys of soil microflora are conducted in various harsh environments such as deserts in an effort to gather experience for similar investigations in extraterrestrial environments. The Valley of the 10,000 Smokes in Alaska's Katmai Peninsula is a harsh environment, and a desert in the sense of sparse support for animal and plant life, but water is not a limiting factor. The area is characterized by high annual rainfall, low annual mean temperature, few sunny days, a soil derived from volcanic eruptions in 1912, soil-eroding winds, and a large number of dying fumaroles. Studies were conducted involving physical and physicochemical soil properties and determinations of soil microflora. Algae, mosses, and liverworts present 40 years ago have died out with the dying fumaroles and cannot become established in other areas due to the sandblasting of the high winds. Soil porosity is high causing rapid drainage and runoff. The soil microflora were limited by a number of soil factors: (1) Low available water (2) Sparse macrovegetation (3) Low clay composition (4) High specific gravity and low bulk density resulting in high erodability (5) A pH-Eh millieu maintaining acidic, reduced and anaerobic conditions (6) Low electrical conductivity and related osmotic pressure values (7) Low percentages of extractable ions (8) Possible Al toxicity (9) Low C, H, and N percentages (10) Generally low wet/dry reflectivity ratios. (Casey-Arizona)
W70-08535

2H. Lakes

PLANKTON COMMUNITY AND HYDRAULIC CHARACTERIZATION PRELIMINARY TO LAKE FLUSHING,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05C.
W70-08166

PALYNOLOGICAL TRACING OF SALINE WATER SOURCES IN LAKE KINNERET REGION (ISRAEL),
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
A. Horowitz.
Journal of Hydrology, Vol 10, No 2, p 177-184, Feb 1970. 8 p, 1 fig, 2 tab, 17 ref.

Descriptors: *Saline water systems, *Springs, *Lakes, *Tracking techniques, *Palynology, Brines, Discharge (Water), Groundwater movement, Tracers, Water chemistry, Water quality, Mixing, Water sources, Provenance.
Identifiers: Lake Kinneret (Israel).

lynological spectra of water samples represent-
g four groups of saline sources are compared with
freshwater spectrum in Lake Kinneret region.
ie palynological spectra indicate that the saline
iters are a mixture of recent water with active
uifers from an intake area in the mountains west
the lake that dilute in various proportions con-
ntrated saline solutions of Upper Pliocene to
ower Pleistocene age. (Knapp-USGS)
70-08209

EMPERATURE MICROSTRUCTURE IN A RESH WATER THERMOCLINE,
arine Sciences Lab., Menai Bridge (Wales); and
itish Meteorological Office, Bracknell (En-
and).
H. Simpson, and J. D. Woods.
ature, Vol 226, p 832-834, May 30, 1970. 3 p, 4
, 2 ref.

escriptors: *Surface waters, *Lakes, *Water tem-
rature, *Fresh water, *Thermocline, Velocity,
ermal stratification, Stratification, Density
ratification.
entifiers: *Temperature microstructure, *Loch
ess.

ecent measurements of microstructure in the
ean show a steplike distribution of temperature,
linity and velocity. One school of thought ex-
ains the microstructure in terms of interleaving of
yers originating at different locations, while
other suggests that vertical diffusion of heat, salt
d momentum may inevitably result in the
velopment of layers. Observations in Lake Bala
Merionethshire and of the thermocline of Loch
ess, a Scottish freshwater lake about 30 km long
d 1 km wide and with an average depth of nearly
0 m both showed microstructure. The vertical
ale of the thermocline microstructure found in
ch Ness is indistinguishable from that found in
e Mediterranean thermocline and in weakly
ratified water in the Pacific Ocean. Temperature
icrostructure in a freshwater lake demonstrates
at salinity gradients are not an essential factor in
e generation of ocean microstructure.
Woodard-USGS)
70-08251

EAT TRANSFER COEFFICIENT IN WATER ODIES WITH LIMITED FLOWAGE DURING UMMER HEATING,
or primary bibliographic entry see Field 02C.
70-08269

/ATER QUALITY BEHAVIOR IN RESER-OIRS,
onsumer Protection and Environmental Health
ervice, Cincinnati, Ohio.
or primary bibliographic entry see Field 05C.
70-08278

IMNOLOGICAL CONDITIONS IN VOLTA AKE, THE GREATEST MAN-MADE LAKE OF FRICA,
hana Academy of Sciences, Accra. Inst. of
quatic Biology.
. Entz.
ature and Resources, Vol 5, No 4, p 9-16, Dec
969. 8 p, 3 fig, 1 tab.

escriptors: *Limnology, *Lakes, Lake fisheries,
ake breezes, Aquatic life, Water quality, *Dis-
olved oxygen, Aquatic plants, Floating plants,
ligotrophy, *Aquatic weeds, Water chemistry,
/ater analysis, Hydrology, Dissolved solids, Ther-
ocline, Turbidity, Rainfalll, *Reservoirs, Foreign
rojects, Reservoir fisheries, Hypolimnion.
dentifiers: *Lake Volta, Ghana, Floating weeds,
frica, Ghana.

he limnological conditions in Volta Lake were
udied for fishery and other applied scientific pur-
oses, and to gather fundamental data on this
ewly formed tropical lake. Results are sum-
marized on the present state of the lake, effect of certain factors affecting its condition, major conditions occurring since formation of the lake, and some indications of further changes in the near future. The oxygen content was very low in the first 3 yr and well-oxygenated zones were restricted to the uppermost 5 to 10 m strata. Dissolved oxygen increased considerably in the next several years and seasonal fluctuations appeared. The increase in dissolved oxygen appears to be caused by wind activity and a decrease in oxygen consumption from the decomposition of organic material. Floating plants are very abundant in certain sections of the lake, sometimes forming dense mats; under the mats, the water is almost devoid of oxygen and is without fish and other higher aquatic life. The plants are also hosts for snails which are vector organisms for human diseases. Manmade lakes in northern countries should reach stabilized limnological conditions in 20 to 25 yr. In the tropics, changes occur more rapidly and stabilized conditions may be achieved in Lake Volta within 5 to 10 yr. (USBR)
W70-08445

NEARSHORE UNDER ICE WATER MOVEMENT AT NANTICOKE, LAKE ERIE - 1970,
Ontario Water Resources Commission, Toronto. Great Lakes Water Quality Surveys Program.
M. D. Palmer, and J. B. Izatt.
Ontario Water Resources Commission Report, Great Lakes Water Quality Surveys Program, May 1970. 22 p, 5 fig, 6 tab, 2 ref, 3 append.

Descriptors: *Currents (Water), *Lake Erie, *Iced lakes, Lake ice, Measurement, Current meters, Dispersion, Path of pollutants, Water quality control.
Identifiers: Nanticoke (Ontario).

Currents were measured at Nanticoke, Lake Erie, with a recording current meter from December 1969 to March 1970, when an ice cover existed in the area. The currents were measured at a fixed point 700 m from the shore at a point 3 m from the bottom in 11 m of water. The water movements were generally in the same direction as those without an ice cover; however, longer periods of little or no water movement existed. Periods of velocity jetting occurred after the ice cover formed. The mean monthly and hourly dispersion characteristics with an ice cover were significantly less than without an ice cover, particularly in February, indicating the need to avoid waste discharges in the adjacent nearshore areas. (Knapp-USGS)
W70-08479

STRATIFIED RESERVOIR CURRENTS, PARTS 1 AND 2,
Oregon State Univ., Corvallis. Engineering Experiment Station.
Larry S. Slotta, E. Harvey Elwin, Howard T. Mercier, and Michael D. Terry.
Available from the Clearinghouse as PB-188 356, $3.00 in paper copy, $0.65 in microfiche. Oregon State University Engineering Experiment Station Bulletin No 44, October 1969. 158 p, 46 fig, 43 ref. FWQA Project 16080 DRX---10/69.

Descriptors: *Stratification, *Reservoirs, *Water quality, *Mathematical models, *Stratified flow, Currents (Water), Density stratification, Density currents, Model studies, Hydraulic models, Mixing, Flow, Open channel flow, Hydrodynamics, Hydraulics, Simulation analysis, Fluid mechanics.
Identifiers: Stratified reservoirs.

This volume contains two papers devoted to stratified currents research at Oregon State University under the sponsorship of the United States Department of the Interior, Federal Water Pollution Control Adminstration. The general purpose of the work was the investigation of the internal currents created by withdrawal from reservoirs stratified by surface heating. Special attention was given to the effects of entering streamflow and withdrawal on currents. Time-lapse photographic techniques for recording flows through a density stratified impoundment model permits viewing a lengthy experiment (1-1/2 hours) in a few minutes in movie form. Specific studies on geometrical effects of boundaries on internal currents have been conducted. Graphic displays of time development of internal stratified flows have been simulated using digital computers. (See also W70-08502 and W70-08503) (Knapp-USGS)
W70-08501

THREE STATISTICAL PROGRAMS TO PROCESS LIMNOLOGICAL DATA,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
H. E. Sweers.
Canada Department of Energy, Mines and Resources, Marine Sciences Branch Manuscript Report Series, No 13, 1970. 55 p, 3 fig, 7 ref, 5 append.

Descriptors: *Computer programs, *Statistical methods, *Data processing, *Limnology, Hydrologic data, Statistics, Water temperature, Thermocline, Epilimnion, Hypolimnion, Mixing, Data collections.
Identifiers: Limnological data.

Three programs, written in Fortran IV for a CDC 3100 computer, were designed to calculate means, standard deviations, standard errors and other statistics of various limnological parameters. STATISTICS I gives weighted cruise-mean values, cruise-mean epilimnion and hypolimnion values, tabulations of the relation between temperature and other parameters, and near-bottom means. STATISTICS II is especially designed to study regional anomalies in the distribution of any parameter. STATISTICS III is a more specialized program analyzing the variability in a set of data in terms of random and systematic components. (Knapp-USGS)
W70-08508

PRODUCTION RATE OF THE PERIPHYTON IN LAKE TIBERIAS AS MEASURED BY THE GLASS SLIDE METHOD,
Hebrew Univ., Jerusalem. Dept. of Botany.
Inka Dor.
Israel Journal of Botany, Vol 19, No 1, p 1-15, 1970. 3 fig, 6 tab, 21 ref.

Descriptors: *Periphyton, *Algae, *Primary productivity, *Lakes, Biomass.
Identifiers: *Israel, *Lake Tiberias, Photophilic animals, Mediterranean climates.

The periphyton of Lake Tiberias are mainly Diatomeae who cling to the basaltic rocks and stones along the shore. Glass slides arranged vertically in wooden frames were submerged for 26-35 days and analyzed for biomass. Net production rate (NPR) values fluctuated sharply with time, rising steeply in the spring, peaking for a short duration, then dropping to low summer levels followed by a smaller autumn peak. All dominant species were represented in the spring peak. The seasonal fluctuations had a coefficient of variation of 15.5 percent in the spring and 7.5% in the autumn, and were characteristic of biological activity in subtropical Mediterranean climates. NPR values decreased with depth, indicating extremely photophilic populations. A shore strip of 14 square kilometers had an estimated production potential of 1533 tons of organic matter per year. Although the actual productivity of the strip could not be exactly measured, indirect methods indicated it was 42.5 percent of potential productivity, or 650 tons of net organic matter per year. (See also W70-08534) (Casey-Arizona)
W70-08533

EVAPORATION FROM LAKE TIBERIAS: AN ESTIMATE BY THE COMBINED WATER BALANCE-MASS TRANSFER APPROACH,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.

G. Stanhill.
Israel Journal of Earth-Sciences, Vol 18, p 101-108, 1969. 4 fig, 1 tab, 11 ref.

Descriptors: *Lakes, *Evaporation, *Seepage, *Mass transfer, *Water balance, Vapor pressure.
Identifiers: *Israel, *Lake Tiberias, Wind run.

Ten years of hydrological and meterological records from Lake Tiberias, insufficient in themselves, were combined to yield an estimation of evaporative loss. The sum of evaporation (E) and net seepage flow (S) were poltted against the mass transfer coefficient (N). The value of E + S was determined by a water balance equation utilizing values for inflow, outflow, rainfall and monthly charges in water level. S is not constant throughout the year, but linear curves may be obtained only with data from constant periods. In January, February and March, net inflow is greater than evaporative loss. Two separate linear relationships could be fitted to the data if those months were excluded. The slopes of the 2 curves were identical and the estimate of 1844 mm annual evaporation agreed within 10 percent of previous estimates. Deficiencies in the climatic and hydrological data and possible errors due to theoretical oversimplification are discussed. (See also W70-08533) (Casey-Arizona)
W70-08534

THE TEMPERATURE OF LAKE TIBERIAS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
G. Stanhill.
Israel Journal of Earth-Sciences, Vol 18, p 83-100, 1969. 10 fig, 3 tab, 10 ref.

Descriptors: *Lakes, *Water temperature, *Thermal properties, Isotherms, Diurnal distribution, On-site investigations.
Identifiers: *Israel, *Lake Tiberias, Areal variation, Heat storage, Surface temperature.

Water temperature measurements on the surface and at various depths at 15 stations on Lake Tiberias were replicated over a period of 2 years. Annual temperature ranges were 16.6 and 19.6 degrees centigrade, equivalent to heat storage changes of 40,000 and 47,240 calories per square centimeter per year. These figures were less than those found in previous years, possibly because of recent drainage project in the area. Areal variations are less than 2 degrees at the surface and increase with depth at shallow levels. Diurnal variations were greatest in surface waters decreased with depth, rarely exceeded 2.5 degrees, and were greatest in summer. Although considerable annual differences in the thermal regime of the lake were found, there is as yet insufficient data for conclusions concerning long term trends.
W70-08537

2I. Water in Plants

WATER BALANCE OF SOME WARM DESERT PLANTS IN A WET YEAR,
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 02D.
W70-08175

HYDROGEN ISOTOPIC FRACTIONATION OF WATER PASSING THROUGH TREES,
Geological Survey, Denver, Colo.; and Agricultural Research Service, Fort Collins, Colo
For primary bibliographic entry see Field 02K.
W70-08186

EVAPOTRANSPIRATION MEASUREMENT BY CHLORIDE TRANSLOCATION,
Agricultural Research Service, Reno, Nev. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02D.
W70-08210

INFLUENCE OF IRRIGATION INTERVAL AND PLANT DENSITY OF ALFALFA SEED PRODUCTION,
American Univ., Beirut (Lebanon). Faculty of Agricultural Sciences.
For primary bibliographic entry see Field 03F.
W70-08341

MOISTURE AND TEMPERATURE EFFECTS ON EMERGENCE AND INITIAL GROWTH OF TWO RANGE GRASSES,
Agricultural Research Service. Crops Research Div.; and New Mexico Agricultural Experiment Station, University Park.
Carlton H. Herbel, and Ronald E. Sosebee.
Agronomy Journal, Vol 61, No 4, p 628-631, July-August 1969. 9 tab, 6 ref.

Descriptors: *Gamma grasses, *Plant growth, *Soil temperature, *Soil moisture, *Arid lands, Range grasses, Forage grasses, Desert plants, Southwest U. S., Semiarid climates, Moisture tension, Moisture stress, Field capacity, Limiting factors, Evaporation.
Identifiers: *Boer lovegrass, *Survival, *Seedlings, *Emergence, *Desert grasslands.

Researchers studied the effects of two temperature regimes and five moisture levels on early growth of boer lovegrass (Eragrostis chloromelas Steud.) and black grama (Bouteloua eriopoda (Torr.) Torr.). Depending on the moisture level, daily maximum soil temperatures ranged from 38 to 51 deg C (low temperature regime) and from 53 to 67 deg C (high temperature regime). Of the five soil moisture levels, level A was approximately at field capacity. Levels B and C were watered as level A on the planting day, then reduced to about one-half and one-third, respectively, of level A for the duration of the trial. Levels D and E were watered as level A for the first three days, then reduced in the same manner as levels B and C. In the 21-day experiment it took 231 mm of water for either species to survive in the high temperature regime, but only 70 mm of water to survive in the low one. Soil moisture reduction a day after planting decreased seedling survival more than moisture reduction on the third day after planting. Neither grass emerged at moisture levels B and C in the high temperature regime. Survival of these species in the Southwest would be enhanced by lower soil temperatures and less evaporation from the soil surface. (Carr-Arizona)
W70-08342

IRRIGATED WHEAT ON A CALCAREOUS SOIL AS AFFECTED BY APPLICATION OF NITROGEN, PHOSPHORUS, POTASSIUM, AND ZINC: I. YIELD, COMPOSITION, AND NUMBER OF HEADS,
American Univ., Beirut (Lebanon). Faculty of Agricultural Sciences.
For primary bibliographic entry see Field 03F.
W70-08343

REPRODUCTION BIOLOGY OF THE INDIAN DESERT HARE, LEPUS NIGRICOLLIS DAYANUS BLANFORD,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Animal Studies.
I. Prakash, and G. C. Taneja.
Mammalia, Vol 33, No 1, p 102-117, March 1969. 3 fig, 8 tab, 23 ref.

Descriptors: *Xerophilic animals, *Mammals, *Monsoons, *Reproduction, *Impact (Rainfall), Physiological ecology, Arid lands, Animal behavior, Precipitation (Atmospheric), Wet seasons.
Identifiers: *India, *Rajasthan desert, *Desert hare, *Animal-plant relationships, Rabbits, Annual productivity.

Desert hares were shot and collected every month, for a year, in the Jodhpur region of the Rajasthan desert. The testes were weighed and epididymal smears were taken on male specimens. The numbers of pregnant and lactating females were determined and the corpora lutea and embryos were counted. From these figures, blastocyst transfers, embryonic mortality and annual productivity per female could be estimated. The number of pregnant females and the number of embryos per pregnant female were highest during the monsoon season of July-September when daylength and green forage availability were optimal. The testes weights fluctuated in parallel with the pregnancies, the right testes being significantly heavier than the left. Although breeding activity in different areas could be directly correlated with local forage quality, it was felt that the increase in prevalence of pregnancy during the April-June hot, dry months indicated other reproduction limiting factors in addition to green forage. The annual production of young per female was estimated to be 10.66. It was concluded that seasonal breeding of the Indian hare is in general conformity with seasonal breeding in species of this genus from all over the world. (Casey-Arizona)
W70-08345

SEASONAL CHANGES IN BODY FLUIDS IN A FIELD POPULATION OF SPADEFOOT TOADS,
Southwestern Research Station, Portal, Ariz.; and California Univ., Dept. of Life Sciences.
V. H. Shoemaker, L. McClanahan, Jr., and R. Ruibal.
Copeia, No 3, p 585-591, August 1969. 4 fig, 1 tab, 12 ref.

Descriptors: *Toads, *Arizona, *Amphibians, *Animal physiology, *Osmotic pressure, Moisture stress, Electrolytes, Ureas, Urine, Moisture stress, Moisture uptake, Arid lands, On-site investigations, Animal metabolism, Soil moisture.
Identifiers: *Anurans, *Spadefoot toads, Plasma, Bladder water, Total solute concentrations.

Many anuran amphibian species in arid regions burrow during the dry seasons and emerge during the wet seasons. In an effort to determine body fluid balances in these animals, individuals of 2 species of spadefoot toads (Scaphiopus hammondii and Scaphiopus couchii) in southeastern Arizona were unearthed at 3 different times of the year: (1) September - shortly after burrowing (2) March-about the middle of the dry season (3) June - shortly before emerging. Electrolytes, urea, total solute concentrations in urine and plasma, and bladder urine volume were measured. These were correlated with soil moisture tension. In September and March bladder urine volume and solute concentrations in urine and plasma were equivalent to their levels in fully hydrated animals. In June, all plasma solute levels and urinary urea levels were higher and soil moisture content was lower. This was interpreted as resulting from changes in soil moisture tension during the advance of the dry season. In September and March the toads were presumably capable of passive water uptake from the soil, but by June soil water potential had decreased enough to raise total solute concentrations through the effects of net water loss and metabolic urea production. (Casey-Arizona)
W70-08348

THE ROLE OF THE SEXUAL STAGE IN THE OVER-SUMMERING OF ERYSIPHE GRAMINIS DC. F. SP. HORDEI MARCHAL UNDER SEMI-ARID CONDITIONS,
Technion - Israel Inst. of Tech., Haifa; and Hebrew Univ., Jerusalem (Israel).
K. Koltin, and R. Kenneth.
Annals of Applied Biology, No 2, Vol 65, p 263-268, April 1970. 3 tab, 11 ref.

Descriptors: *Plant diseases, *Pathogenic fungi, *Barley, Parasitism, Arid lands, Grasses, Plant pathology, Growth stages, Water balance, Rainfall, Impact (Rainfall), Leaves, Wet seasons.
Identifiers: *Israel, *Cleistothecia, *Ascospores, Mycelia, Fruiting bodies, Powdery mildew disease, Ascospore differentiation.

owdery mildew disease in barley is caused by the ngal parasite Erysiphe graminis f.sp. hordei. Stues were initiated to determine the role of the sexl stage of the fungus in the epidemiology of this sease in the arid areas of Israel, where the barley owing season and the major rainfall occur from id-October to mid-May, followed by 5-6 rainless onths. All 135 sown barley varieties were atcked by the fungus in at least one nursery, with e appearance of cleistothecia. No ascospores ere found during the growing season or summer. leistothecia collected on dry leaves from May ntil first rains, were kept in constant moisture and most always produced ascospores within 72 ours, but those collected during the rainy season ook up to 264 hours for ascospore differentiation nder the same conditions. Ascospore differentiaon cannot be induced during early or late spring ins, but it does occur during the first autumn ins and this can be correlated with seed induction the barley. In Israel, therefore, a sexual stage is roduced in early spring which tides the fungus ver the summer and produces inoculum for newly nerging host in the fall. (Casey-Arizona)
/70-08349

UMMER FALLOW FOR DRYLAND WINTER /HEAT IN THE SEMIARID GREAT PLAINS,
gricultural Research Service. Northern Plains ranch; and Nebraska Univ., North Platte. Agricural Experiment Station.
or primary bibliographic entry see Field 03F.
/70-08350

ODY FLUID PARTITIONING IN REPTILIA,
lebraska Univ., Lincoln. Dept. of Zoology.
homas B. Thorson.
opeia, No 3, p 592-601, June 3, 1969.

escriptors: *Reptiles, *Water balance, *Animal etabolism, Physiological ecology, Animal hysiology.
dentifiers: *Body fluids, *Fluid compartments, Body water content, Extracellular water, Intracelular water, Blood volume, Plasma volume.

y injection of sucrose and Evans blue dye into cirulatory systems, the relative amounts of ody fluid n the major fluid compartments of reptiles were etermined. The species studied were about evenly ivided between marine, terrestrial, and freshwater orms. Specific gravities and volumes of whole lood and plasma, hematocrits, and extracellular nd interstitial fluid volumes were all lowest in the reshwater forms. Conversely, the freshwater forms ad the greatest total body water and intracellular luid volumes. The marine and terrestrial habitats ere considered analogous from the standpoint of ater economy since their fluid partitioning difered in a similar fashion from the freshwater orms, although the marine patterns were omewhat more pronounced. Marine and terrestrial forms have lower body water contents because lehydrating stress is not fully compensated for, lthough extracellular fluid volume is kept high at he expense of protoplasmic water. It is unclear whether the fluid partitioning in the various forms s genetically determined or a response to osmotic tress. (Casey-Arizona)
W70-08354

MYCORRHIZA IN DESERT SOILS,
Northeastern Univ., Boston, Mass. Dept. of Biolo-gy.
A. K. Khudairi.
Bioscience, Vol 19, No 7, p 598-599, July 1969. 1 ig, 8 ref.

Descriptors: *Root systems, *Fungi, *Nitrogen fixng bacteria, *Soil-water-plant relationships, Lichens, ARID LANDS, Xerophytes.
dentifiers: *Iraq, *Mesopotamian desert, *Mycorrhizas, Mycelia, Nutrient cycling.

Mycorrhizas are fungal symbionts associated with many species of cultivated plants and small native desert shrubs in the Mesopotamian desert. Another symbiont in the native shrubs in the nitrogen fixing bacteria, Rhizobium, in the root nodules. When leaves fall in the autumn, nitrogen is added to the soil and its absorption is facilitated by the mycorrhizas. Phosphorus and potassium are also rare in desert soils and their uptake is enhanced by the mycorrhizas. Despite the low soil organic matter, many other fungi such as truffles occur in desert soils. They, together with lichens, mycorrhizas, and soil and root bacteria, form a complex and efficient nutrient recycling system in desert soils. (Casey-Arizona)
W70-08355

STUDIES IN WATER RELATIONS OF RICE,
Calcutta Univ. (India).
P. K. Sen, and D. K. Das Gupta.
The Indian Journal of Agricultural Sciences, Vol 39, No 10, October, 1969, p. 1000-1009. 4 tab, 3 fig, 10 ref.

Descriptors: *Water requirements, Water levels, *Irrigation effects, Fertilizers, *Rice, Nitrates, Fertilizers, *Plant growth.
Identifiers: Chinsurah, West Bengal, India, Ammonium sulphate, Rice varieties, (CB1, Dhairal, Bhasamanik, Dular).

This paper measured the effects of season, water quantity and nitrogen levels on yields of rice in India. Based on experimentation with three varieties of rice, the authors concluded that there is a 'mutual interdependence' between water and nitrogen levels. Under high water levels they found a moderate amount of nitrogen (e.g. 45 kilograms per hectare) produced optimum yields; and with moderate water levels a higher amount of nitrogen was necessary. Also reported was preference for the growing season of November to April. (Holmes-Rutgers)
W70-08358

PEANUT RESPONSE TO UNIFORM AND NON-UNIFORM SOIL SALINITY,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 03C.
W70-08521

FOOD AND WATER REQUIREMENTS OF DORCAS GAZELLE IN THE SUDAN,
Khartoum Univ. (Sudan). Dept. of Zoology.
D. B. Carlisle, and L. I. Ghorbial.
Mammalia, Vol 32, No 4, p 570-576, December, 1968. 2 fig, 1 tab, 5 ref.

Descriptors: *Xerophilic animals, *Mammals, *Ruminants, *Food habits, *Leaves, Water conservation, Legumes, Arid lands, Deserts, Droughts, Xerophytes, Moisture availability, Animal metabolism, Drought tolerance, Physiological ecology, Nutrient contents, Water balance.
Identifiers: *Sudan, *Gazelles, *Acacias, *Animal-plant relationships, Leaf moisture content, Crepuscular animals.

Dorcas gazelles, Gazella dorcas dorcas (Linne), were observed in a number of localities in northern Sudan during a 6 month dry period when no green grass was evident. They were essentially crepuscular and fed only on Acacia tortilis, never dry grass or any other green shrub. Acacia tortilis is an arid zone bush which retains its leaves for about 18 months after the last rain. Leaves were analyzed for moisture and nutrient contents as a function of time since the last rainfall. Leaves from areas with a span of 10-40 weeks since last rainfall had a mean moisture content of 6 percent which was not correlated with time within that span. A sample from an area of 80 weeks since last rainfall showed a drop in mean moisture content to 48.6 percent with mean protein, carbohydrate, fibre, ash and calorific contents increasing from 20-45 percent over the 10-40 week samples. The calorific and water requirements of captive gazelles feeding on sorghum were measured. This data was then used to estimate weights of Acacia leaves necessary for consumption in satisfying those requirements. It was concluded the Dorcas gazelle, unlike a close relative, Thompson's gazelle, may survive dry periods without drinking by eating only Acacia leaves, and need move out of a drought-stricken region only after the leaves have fallen. (Casey-Arizona)
W70-08529

AFTER-EFFECT OF WATER STRESS ON STOMATAL OPENING POTENTIAL I. TECHNIQUES AND MAGNITUDES,
California Univ., Davis. Lab. of Plant-Water Relations.
R. A. Fischer, Theodore C. Hsiao, and Robert M. Hagan.
Journal of Experimental Botany, Vol 21, No 67, p 371-385, May 1970. 7 fig, 4 tab, 21 ref. OWRR Project B-029-CAL.

Descriptors: *Stomata, *Moisture deficit, *Leaves, *Turgidity, Tobacco, Beans, Plant physiology, Moisture uptake, Moisture stress, Drought tolerance, Photoactivation, Water balance, Carbon dioxide.
Identifiers: *Leaf turgor, *Stomatal opening potential, *Leaf discs, Resistance porometer, Fick's law, Stomatal resistance.

During periods of drought, plant leaf stomata close up, thereby decreasing carbon dioxide uptake, which contribute to the general decline of the plant. Leaf discs from tobacco (Nicotiana tabaccum) and broad beans (Vicia faba) were floated on distilled water, under conditions of high relative humidity, low air turbulence, and controlled illumination and temperature, until they reached full turgor. Their stomatal aperture sizes were then estimated by use of a resistance porometer and usually also measured directly. Following a period of stress, the effects of a 30-40 percent water deficit in tobacco leaves involved a markedly lowered ability to open in light and lasted approximately 2-5 days after rewatering. Some leaves recovered to levels greater than the controls, probably due to arrested senescence during stress. Leaf production ceased abruptly during stress and recovered with rewatering. Depressions in stomatal opening potential were positively correlated with extent of deficit but recovery time was independent of duration and severity of stress. The effects of stress in beans were similar, but less pronounced than those in tobacco except that dry weight was not affected and stomatal function recoveries never exceeded control levels. The leaf disc assay technique eliminated the possibility that the measured stomatal after-effect was directly caused by persistence of small leaf-water-deficits. In an Appendix section the validity of the leaf disc assay method is examined. (See also W70-08531) (Casey-Arizona)
W70-08530

AFTER-EFFECT OF WATER STRESS ON STOMATAL OPENING II. POSSIBLE CAUSES,
California Univ., Davis. Lab. of Plant-Water Relations.
R. A. Fischer.
Journal of Experimental Botany, Vol 21, No 67, p 386-404, May 1970. 10 fig, 3 tab, 27 ref. OWRR Project B-029-CAL.

Descriptors: *Moisture stress, *Stomata, *Carbon dioxide, *Leaves, *Turgidity, Tobacco, Beans, Photosynthesis, Plant physiology, Moisture uptake, Moisture deficit, Drought tolerance, Photoactivation, Water balance, Metabolism.
Identifiers: *Guard cells, *Leaf discs, *Stomatal opening potential, Stomatal resistance, Metabolic inhibitors, Carbon dioxide compensation point.

Changes in stomatal apertures by transfers of epidermal strips of bean leaf between stressed and control mesophyll and reduction of the after effect on mean aperture in bean and tobacco leaf strips in carbon dioxide - free air indicated that about one-third of the after effect could be attributed to

changes in leaf mesophyll, probably through elevated substomatal cavity carbon dioxide levels. Although this explanation is not supported by carbon dioxide compensation point measurements, increased sensitivity of poststress discs to photosynthetic inhibitors is consistent with it, and on balance it is thought valid. Large after-effects in epidermal strips lacking mesophyll indicated guard cells were primarily responsible for two-thirds of the phenomenon. Neither carbon dioxide- free air nor metabolic inhibitors, in short term application, appreciably reduced the after-effects, and starch levels in the guard cells did not decrease during the water stress. Stomatal recovery in post-stress tobacco leaves indicated recovery required light and time. However, light was ineffective in carbon dioxide-free air and the light requirement was completely replaced by the addition of glucose-l-phosphate. Recovery may involve 2 temporally separate steps only one of which requires light and probably photosynthate. It was concluded that although guard cell activity is the major factor in the post-stress damage, the mechanisms are not understood. (See also W70-08530) (Casey-Arizona)
W70-08531

PRODUCTION RATE OF THE PERIPHYTON IN LAKE TIBERIAS AS MEASURED BY THE GLASS SLIDE METHOD,
Hebrew Univ., Jerusalem. Dept. of Botany.
For primary bibliographic entry see Field 02H.
W70-08533

SOIL MICROBIAL ECOLOGY OF VALLEY OF 10,000 SMOKES, ALASKA,
Jet Propulsion Lab., Pasadena, Calif.
For primary bibliographic entry see Field 02G.
W70-08535

EFFECT OF MOISTURE TENSION, TEMPERATURE AND LIGHT ON GERMINATION OF FOUR EXOTIC RANGE GRASSES,
Institute for Research on Natural Resources, Abu-Ghraib (Iraq).
Tariq A. Al-Ani, and Nazar A. Ouda.
Annals of Arid Zone, Vol 8, No 1, p 45-51, March 1969. 2 fig, 2 tab, 12 ref.

Descriptors: *Germination, *Xerophytes, *Range grasses, *Temperature, *Moisture stress, Arid lands, Osmotic pressure, Moisture tension, Drought tolerance, Plant growth, Light.
Identifiers: *Iraq, *Germination rate, Mannitol.

Four species of imported palatable pasture grasses, Cenchrus ciliaris, Cenchrus setigerus, Eragrostis superba and Panicum antidotale, were tested for germination capabilities in varying temperatures in dark and light, and under varying moisture stresses. In temperature studies ranging from 20-30 degrees centigrade, it was found that germination rates increased with temperature. Only E. superba showed a preference for light in final germination at higher temperatures. D-mannitol, at osmotic concentrations ranging from 1/3-15 atmopheres simulated drought conditions. In all cases, as moisture tensions increased, germination rate decreased and time to final germination increased. However, the 4 species responded differentially, and the descending order in ability to germinate under drought conditions was: C. setigerus, C. ciliaris, E. superba and P. antidotale. Seeding growth under differing moisture tensions, as measured by plumule and radicle growth, also showed differential responses. The descending order of growth ability under drought conditions was E superba, C setigerus, C. ciliaris and P antidotale (Casey-Arizona)
W70-08536

2J. Erosion and Sedimentation

THE USE OF GRAVITY SHAFTS FOR GROUNDWATER RECHARGE - PHASE I,
North Dakota Water Resources Research Inst., Fargo
For primary bibliographic entry see Field 04B.
W70-08152

A BURET CYLINDER FOR GRAIN-SIZE ANALYSIS OF SILT AND CLAY (WITH ALGOL-PROGRAM),
Technische Hochschule, Munich (West Germany). Sedimentology and Marine Geology Div.; and Bayerische Landesstelle fur Gewasserkunde, Munich (West Germany).
F. Fabricius, and St. Muller.
Sedimentology, Vol 14, No 1-2, p 39-50, April 1970. 12 p, 6 fig, 1 tab, 13 ref.

Descriptors: *Computer programs, *Analytical techniques, *Particle size, *Silts, *Clays, Sediments, Suspended load, Turbidity, Settling velocity, Sieve analysis.
Identifiers: *Particle size analysis.

A new apparatus, using a buret cylinder was constructed in order to increase the efficiency of the size analysis of fine-grained sediments. Its uncomplicated operation and automatic leveling enable working series of 10 samples or more at a time. This method, an improvement of the pipet method, works with an accuracy comparable to that of the Atterberg method. An ALGOL-program was compiled to compute all data obtained from the granulometric analysis of sediments. In the output, the numerical parameters are printed out and a simple frequency and a cumulative diagram is plotted. The computer program works for grain sizes from -6 phi to +9 phi. Two procedures can be applied alternatively: (a) sieving--buret analysis; and (b) sieving--visual accumulation tube--buret analysis. (Knapp-USGS)
W70-08169

TREATMENT OF SPHERICITY AND ROUNDNESS DATA OF QUARTZ GRAINS OF CLASTIC SEDIMENTS,
Regional Engineering Coll., Rourkela (India). Dept. of Geology.
Basanta K. Sahu, and B. C. Patro.
Sedimentology, Vol 14, No 1-2, p 51-66, April 1970. 16 p, 13 tab, 21 ref.

Descriptors: *Particle shape, *Sands, *Analytical techniques, *Sediments, Sieve analysis, Statistical methods, Quartz, Measurement.
Identifiers: Sphericity, Roundness, Sorting.

Sphericity and roundness data of quartz grains (of varying size) of sieve fractions are empirically shown to be non-normally distributed. It is also demonstrated that log transformations normalize the sphericity and roundness data. Laboratory experiments on sampling quartz grains from a sieve fraction show that the cone-and-quartering method is preferable as it yields similar results to those of the more time-consuming random sampling procedure. Results of laboratory measurement errors on two-dimensional sphericity and roundness data are also presented. The frequency of sphericity and roundness data are noted. For all parametric statistical studies of sphericity and roundness the sample statistics should be calculated according to normalizing log functions. Suitable grade scales of sphericity and roundness data are proposed based on log functions, the total range, and the minimum range of the variates (sphericity and roundness). (Knapp-USGS)
W70-08170

THE IDENTIFICATION OF ANCIENT BEACH SANDS BY THE COMBINATION OF SIZE ANALYSIS AND ELECTRON MICROSCOPY,
A. V. Hodgson, and W. B. Scott.
Sedimentology, Vol 14, No 1-2, p 67-75, April 1970. 9 p, 7 fig, 1 tab, 11 ref.

Descriptors: *Particle size, *Sieve analysis, *Electron microscopy, *Beaches, *Stratigraphy, Sedimentology, Sands, Petrography, Petrology, Sedimentary rocks
Identifiers: Particle surface texture.

The combined use of size analysis and electro microscopy indicates the presence of beach sand within the Lower Carboniferous Fell Sandstone o southeast Scotland and northern England. Environmental interpretations are based on a compariso of the statistical parameters summarizing the siz distributions of the Fell Sandstone specimens wit similar data from modern sediments. The spread o standard-deviation values (sorting coefficients) in dicates the presence of littoral, alluvial, an possibly offshore marine environments within th Fell Sandstone. These environments are furthe defined by plotting standard deviation again skewness on a scatter diagram. Electron micro graphs of the quartz grain surface textures o selected Fell Sandstone specimens corroborate th interpretations based on the size analysis and sho all the diagnostic surface features developed o modern quartz beach sand grains. (Knapp-USGS)
W70-08171

PHYSIOGRAPHIC FEATURES AND STRATIFICATION TYPES OF COARSE-GRAINED POINT BARS: MODERN AND ANCIENT EXAMPLES,
Texas Univ., Austin. Bureau of Economic Geology
J. H. McGowen, and L. E. Garner.
Sedimentology, Vol 14, No 1-2, p 77-111, Apr 1970. 35 p, 25 fig, 1 tab, 25 ref.

Descriptors: *Sedimentary structures, *Alluvi channels, *Flood plains, *Bed load, *Suspende load, Sediment transport, Deposition (Sediments Alluvium, Ripple marks, Dunes, Scour, Erosion Meanders.
Identifiers: Colorado River (Tex), Amite Riv (La), Point bar deposits.

Primary sedimentary structures in modern point bar deposits of the Amite River in Louisiana an the Colorado River in Texas are analogous to fea tures observed in Eocene Simsboro and Pleistocen Colorado River deposits of the Texas Gulf Coast Plain. Stratification consists of large-scale trough fill cross-stratification in the scour pool; trough-fi cross-stratification and foreset cross-stratificatio in the lower point bar; parallel laminae, larg foreset cross-stratification,and trough-fill cross stratification in the chute bar; parallel incline laminae, climbing ripple laminae, and mud drape in the chute fill; and parallel inclined laminae, mu drape, and foreset cross-stratification in overban flood-plain deposits. Fundamental difference between point bars of bed-load streams and mixed load streams are that upper point bar sediment with small trough sets and parallel inclined lamina occur only in fine-grained (mixed load) fluvi deposits, and large scale foresets of chute bars ar common to coarse-grained (bed load) fluvi deposits but are not found in fine-grained fluvia deposits. Upward fining sequences, characteristi of fine-grained fluvial deposits, are uncommon i sediments deposited by bed-load streams such a the Amite and Colorado rivers. (Knapp-USGS)
W70-08172

MICROPROBE STUDY OF DIAGENESIS I CALCAREOUS ALGAE,
Hawaii Inst. of Geophysics, Honolulu.
Ralph Moberly, Jr.
Sedimentology, Vol 14, No 1-2, p 113-123, Apr 1970. 11 p, 6 fig, 14 ref.

Descriptors: *Diagenesis, *Limestones, *Alga *Coral, Marine algae, Atolls, Calcium carbonat Reefs, Analytical techniques, Electron microscopy
Identifiers: Eniwetok Atoll, Electron microprob analysis.

Diagenesis of calcareous algae was investigated b electron microprobe. A few conceptacles and othe cavities in Recent algae specimens are partly completely filled with younger carbonate. In con trast to the surrounding skeleton of about 10-10% mol Mg-calcite, these deposits are either very lo (0-2%) or very high (15-50%) in Mg conten Highest magnesian values in Recent algae studie are thought to be in high-Mg calcites rather than i any other phase, with very few possible exception

alcian dolomite replacing fossil algae in cores om Eniwetok Atoll commonly has Ca-rich lenses sembling exsolution laminae. (Knapp-USGS)
70-08173

VERCONSOLIDATION BY DESICCATION OF OASTAL LATE-QUATERNARY CLAYS IN RAEL,
echnion - Israel Inst. of Tech., Haifa. Dept. of vil Engineering.
mos Komornik, Vera Rohrlich, and Gdalyah iseman.
dimentology, Vol 14, No 1-2, p 125-140, April 70. 16 p, 13 fig, 1 tab, 13 ref, append.

escriptors: *Clays, *Porosity, *Consolidation, Compaction, *Moisture content, Bottom sedients, Pressure, Drying, Laboratory tests.
entifiers: *Israel, Desiccation (Clays).

te Quaternary clays in Haifa Bay and Ashdod arbor, Israel, are overconsolidated by desicca-n. This conclusion was reached through analysis the preconsolidation pressure as function of the tual overburden pressure, and by analogy with ays undergoing desiccation, and confirmed in boratory experiments. It is in agreement with the own geology of the area. For pressures above 2.0 /sq cm, a definite statistical relationship was tablished between the preconsolidation pressure d the in situ void ratio. For lower pressures, the situ void ratio is mainly governed by environ-ental conditions during deposition and thought so to be governed by the clay mineralogy. (K-pp-USGS)
70-08174

LUVIAL SEDIMENT CONCEPTS,
eological Survey, Washington, D.C.
arold P. Guy.
or sale by Superintendent of Documents, U S overnment Printing Office, Wash, D C 20402 - ice $0.65. U S Geological Survey Techniques of ater-Resources Investigations, Book 3, Chapter 1, 1970. 55 p, 25 fig, 6 tab, 112 ref.

escriptors: *Data collections, *Sedimentation, Surveys, *Measurement, Sediment transport, dimentology, Alluvial channels, Alluvium, reamflow, Suspended load, Bed load, Sediment ad, Particle size, Erosion scour, Channel orphology, Sedimentary structures, Planning.
entifiers: Sediment data needs.

easurement of and recording of information out fluvial sediment and related environmental ta needed to maintain and improve basic sedi-ent knowledge are discussed. Concepts presented volve: (1) the physical characteristics of sedi-ent which include aspects relative to weathering, ils, resistance to erosion, and particle size; (2) diment erosion, transport, and deposition charac-ristics, including aspects relative to fine sediment d overland flow, coarse sediment and stream-w, variations in stream sediment concentration, position, and denudation; (3) geomorphic con-derations, including aspects relative to the ainage basin, mass wasting, and channel proper-s; (4) economic aspects; and (5) data needs and ogram objectives to be attained through the use several kinds of sediment records. (Knapp-SGS)
70-08187

QUANTITATIVE MODEL OF CLIMBING IPPLES AND THEIR CROSS-LAMINATED EPOSITS,
eading Univ. (England). Sedimentology Research ab.
R. L. Allen.
dimentology, Vol 14, No 1-2, p 5-26, April 1970. p, 7 fig, 2 tab, 24 ref.

escriptors: *Sedimentary structures, *Ripple arks, *Analytical techniques, *Stratigraphy, Deposition (Sediments), Bed load, Sediment transport, Suspended load, Streamflow, Scour, Stream erosion, Mass transfer, Mathematical studies, Equations.
Identifiers: Climbing ripples, Cross-bedding.

The angle of climb of ripples in cross-laminated deposits is governed by a simple relation in which the angle of climb is a function of the rate of sediment deposition normal to the rippled bed, the ripple height, and the bedload sediment transport rate. This relation is developed using sediment transport functions and the assumptions of gradually varied flow to predict the spatial patterns of cross-lamination types in deposits due to pure nonuniform flow, pure unsteady flow, and simulataneous nonuniform and unsteady flow. Most of the predicted patterns can be matched from the geological record, and the analysis affords insight into the environmental significance of climbing-ripple cross-lamination. The analysis also results in a rigorous definition of the kinds of environmental interpretation that may legitimately be made from examples of this structure. (Knapp-USGS)
W70-08194

A STUDY OF THE DYNAMICS OF SUSPENDED MATTER BY MEANS OF NATURAL RADIOACTIVE TRACERS: AN APPLICATION TO THE GIRONDE ESTUARY,
Paris Univ., Thonon-les-Bains (France). Center for Geodynamic Research; and National Hydrological Lab., Chatou (France).
For primary bibliographic entry see Field 02L.
W70-08195

THE SEDIMENTS AND SEDIMENTARY PROCESSES OF THE EASTERN MISSISSIPPI CONE, GULF OF MEXICO,
Florida State Univ., Tallahassee. Dept. of Geology.
For primary bibliographic entry see Field 02L.
W70-08200

THE MEASUREMENT OF THE SIZES OF NON-SPHERICAL PARTICLES BY THE HYDROMETER METHOD,
Reading Univ. (England). Sedimentology Research Lab.
C. McCann.
Sedimentology, Vol 13, No 3/4, p 307-309, December 1969. 3 p, 3 ref.

Descriptors: *Particle size, *Particle shape, *Measurement, *Hydrometers, Settling velocity, Instrumentation, Analytical techniques.
Identifiers: Equivalent particle diameter.

It is shown that in calculating the viscous force on a nonspherical particle suspended in a fluid, it is necessary to use the largest dimension of the particle. This may be calculated from the diameter of the equivalent sphere obtained from a hydrometer analysis provided the shape of the particle is known. (Knapp-USGS)
W70-08201

A METHOD TO STUDY THE DISTRIBUTION OF HEAVY-MINERAL GRAIN ABUNDANCE IN A TURBIDITE,
Mineral Research and Exploration Inst., Ankara (Turkey).
Teoman N. Norman.
Sedimentology, Vol 13, No 3/4, p 263-280, December 1969. 18 p, 8 fig, 4 tab, 18 ref.

Descriptors: *Sedimentary petroiogy, *Statistical methods, *Distribution patterns, *Frequency analysis, Sedimentation, Particle size, Particle shape, Turbidity currents, Density currents, Bottom sediments, Mineralogy.
Identifiers: *Turbidites.

Variations in the absolute frequencies of individual heavy-mineral species in a turbidite may best be studied by selecting a particular grain size as the 'nominal grain,' and numbers of grains of a particular mineral in all size classes can be converted to nominal grains. The total number of nominal grains per gram of sediment sample is defined as the 'nominal grain abundance,' which is a function of the volume (or weight) of the total mineral in the sample. Study of a simple, graded, Tertiary turbidite indicates that the least vertical change in heavy-mineral content occurs at, or slightly above, the middle part of the bed. Heavy minerals in the distal part of the turbidite have more uniform vertical distribution than in the proximal part. (Knapp-USGS)
W70-08202

GRAIN SIZE OF TURBIDITE RIPPLES,
Groningen Rijksuniversiteit (Netherlands). Geological Inst.
Ph. H. Kuenen, and F. L. Humbert.
Sedimentology, Vol 13, No 3/4, p 253-261, December 1969. 9 p, 2 fig, 8 ref.

Descriptors: *Sedimentary structures, *Ripple marks, *Particle size, *Turbidity currents, Density currents, Silts, Currents (Water), Velocity, Bed load, Suspended load.
Identifiers: Turbidites, Current ripples.

Many current ripples show log-normal grain-size distribution and good sorting. A range in medians was measured from fifty to several hundred microns. Turbidite ripples are log-normal, very well sorted and are restricted to medians of very fine sand to silt (less than 130 microns) because the particles are supplied in suspension at rippling velocity. Experimental suspension current ripples formed at about 50-60 cm/sec are similar in composition and structure to turbidite ripples. The continuous supply results in climbing ripples. The restricted grain size and the internal structure of turbidite ripples both form strong evidence against the action of normal currents. (Knapp-USGS)
W70-08203

GRAIN-SIZE IMAGE OF CLASTIC DEPOSITS,
R. Passega, and R. Byramjee.
Sedimentology, Vol 13, No 3/4, p 233-252, December 1969. 20 p, 5 fig, 9 ref.

Descriptors: *Particle size, *Correlation analysis, Statistics, Statistical methods, Analytical techniques, Mapping, Grading, Sands, Sediments, Sediment transport, Silts.
Identifiers: Grain-size image.

A clastic deposit may be represented by several diagrams. C-M diagrams in which C is the one-percentile, M the median of the grain-size distribution, characterize the coarsest fractions of the samples. F-M, L-M and A-M diagrams in which F, L and A, respectively, are the percentages by weight in the samples of grains finer than 125, 31 and 4 microns characterize the finest fractions. As a group, these diagrams form the 'grain-size image' of a deposit. These parameters were selected because they are closely related to transport and deposition mechanisms. As a consequence, the grain-size image gives fairly precise information on hydraulic conditions under which a deposit is formed. Relationships which exist between certain sizes of clastic grains and the most probable deposition mechanism are used to classify clastic sediments by subdividing them into types indicative of their genesis. Integrated with ecological determinations and sedimentary structure descriptions, grain-size facies maps are a means of environment analysis. (Knapp-USGS)
W70-08204

MEASUREMENT OF PARTICLE SHAPE BY FOURIER ANALYSIS,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
H. P. Schwarcz, and K. C. Shane.
Sedimentology, Vol 13, No 3/4, p 213-231, December 1969. 19 p, 11 fig, 1 tab, 16 ref.

Descriptors: *Measurement, *Particle shape, *Fourier analysis, Statistical methods, Sediments, Sands, Analytical techniques.
Identifiers: Particle shape analysis.

An objective procedure is described for quantifying the shape of two-dimensional closed curves from projections or sections of particles, for example, sand grains. The curves are plotted in polar coordinates, and a harmonic analysis is made by numerical analysis of measurements at equally spaced sample points along the curves. Quantities corresponding to the conventional properties of sphericity and roundness are derived from the Fourier coefficients. Three different measures of roundness are proposed and shown to correlate with visually estimated roundness classes, though also depending to some extent on sphericity. An attempt is described to study the interaction between these two properties by analysis of synthetically rounded plastic particles. (Knapp-USGS)
W70-08205

FLUORESCENT SAND AS A TRACER OF FLUVIAL SEDIMENT,
Geological Survey, Washington, D.C.
Vance C. Kennedy, and Dorothy L. Kouba.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C 20402 - Price $0.30. U S Geological Survey Professional Paper 562-E, pp E1-E13, 1970. 13 p, 14 fig, 4 tab, 21 ref.

Descriptors: *Tracers, *Tracking techniques, *Sediment transport, *Dye releases, Radioactivity techniques, Sands, Tagging, Particle size, Bed load, Suspended load, Sampling, Fluorescence.
Identifiers: Dyed sand particles.

Stream sand coated with fluorescent paint was added at a constant known rate to Clear Creek at Golden, Colo., during a 28-hour period, and the concentration of fluorescent grains was monitored at a point 810 meters downstream from the point of introduction. Stream width in the study reach averaged about 21 m, mean velocity about 1.4 m/sec, and mean discharge 8.2 cu m/sec. Flow was very turbulent over a gravel bed. First-arrival time of fluorescent sand correlated with the square of grain diameter in the range 0.15-0.86 millimeters. Steady-state conditions apparently were achieved for the finer particles, with highest concentrations on the north side and lowest concentrations on the south side of the stream. Lateral mixing of coarser grains was much better than for finer grains. The sediment discharge computed from the tracer-dilution method was about 30% greater than the suspended-sediment discharge computed from suspended samples for the 0.15-0.18mm range and about 200% greater for the 0.38-0.52 mm range. (Knapp-USGS)
W70-08253

MODELLING OF SEDIMENT MOTIONS OFFSHORE,
Asian Institute of Technology, Bangkok (Thailand). Dept. of Engineering
For primary bibliographic entry see Field 02L.
W70-08256

MOBILE BED HYDRAULICS,
Alberta Univ., Edmonton. Dept. of Civil Engineering
T. Blench
Text also in French. Journal of Hydraulic Research, Vol 8, No 2, p 159-187, 1970. 19 p, 8 fig, 1 tab, 17 ref.

Descriptors: *Sediment transport, *Alluvial channels, Hydraulics, Bed load, Suspended load, Sediment load, Turbulent flow, Regime, Streamflow, Open channel flow, Open channels, Channel morphology.
Identifiers: Mobile bed hydraulics.

A definite inductive science of mobile bed hydraulics has been forming during the last decade from a combination of facts and ideas about the self-formation of sediment-bearing canals and rivers, the visibly different phases of bed waves in flumes. Formalization is outlined along essentially the lines which initiated the friction-factor diagram of rigid boundary hydraulics for circular pipes. Recommendations are listed for use in formalizing mobile bed hydraulics and for orienting future research. (Knapp-USGS)
W70-08259

JUMPLIKE MOVEMENT OF A SOLID PARTICLE AT THE BOTTOM OF A TURBULENT STREAM,
K. I. Rossinskiy, and K. S. Lyubomirova.
Transl from Trudy Gos. Gidrologicheskogo Instituta, No 162, p 221-235, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 38-49, 1969. 12 p, 8 fig, 1 tab, 3 ref.

Descriptors: *Sediment transport, *Saltation, *Model studies, Hydraulic models, Flumes, Tractive forces, Suspended load, Bed load, Particle size, Velocity.
Identifiers: *USSR.

To study the movement of sediments in the transitional stage between rolling and suspension, the Moscow Laboratory of the State Hydrologic Institute and the Department of Physics of Moscow State University have taken moving films of rolling and jumping gravel particles in a uniform turbulent stream. The moving films were taken in two series with different bottom roughnesses and flow regimes. The movement of individual gravel particles in the second series of experiments was accompanied by the movement of a suspended load made of suspended polystyrene balls 1-1.15 mm in diameter and of a density of 0.98-1.04. The experiments were made in a glass flume of variable slope, 8 m long and 0.5 m kigh and wide. The optical axis of the camera was directed across the stream and was located 123 cm from the floor. (Knapp-USGS)
W70-08265

RELATIONSHIPS BETWEEN LANDSCAPE-GEOMORPHOLOGICAL FACTORS AND SEDIMENT DISCHARGE IN RIVERS OF WESTERN TRANSCAUCASIA,
L. F. Litvin.
Transl from (Vestnik MGU, geogr. ser.), No 4, p 60-64, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 85-88, 1969. 4 p, 4 fig.

Descriptors: *Sediment yield, *Geomorphology, Provenance, Suspended load, Bed load, Regime, Sediment discharge, Discharge (Water).
Identifiers: *USSR, Transcaucasia.

The Moscow State University Black Sea Expedition determined the sediment discharge at the mouth stations on rivers in western Georgia. All river basins were classified by factors determining sediment discharge, and the sediment discharge was measured in rivers typical of different groups. The basins of some of these rivers (Kodori Bzyb', Inguri) include areas falling in all elevation zones; the headwater of the others in general do not extend beyond the zone of mountains of intermediate elevation. All these rivers pass through the foothills zone and coastal lowland. A definite correlation between the mean elevation of a basin and the runoff of Caucasian rivers has been established. The elevation of the area, the landscape-geomorphological factors governing the existence of an elevational zonality of landscapes, and lithology exert the greatest effect on the modulus of suspended sediment discharge. The steep slopes in the longitudinal profiles of rivers and abundant precipitation in the mountainous country virtually ensure the transport of all suspended sediments beyond its limits. The runoff modulus of bed-load discharge depends primarily on the change in the competence of a stream along its length and the closeness of the sources of coarse material. (Knapp-USGS)
W70-08273

MUD VOLCANO CLAY, TRINIDAD, W. I.,
Columbia Univ., New York. Dept. of Geology.
Paul F. Kerr, and Darlene S. Richardson.
Available from Clearinghouse as AD-691 265 $3.00 in paper copy, $0.65 in microfiche. US Air Force Cambridge Research Laboratories, Bedford, Mass, Scientific Report No 3, April 16, 1969. 22 p, 8 fig, 4 tab, 19 ref. USAF Project No 8623-02-01.

Descriptors: *Volcanoes, *Mud, *Movement, Geology, Gases, Geologic control, Sediments, Clays, Structural geology, Mineralogy.
Identifiers: Mud volcanoes, Trinidad (W. I.), Thixotropic mud.

Laboratory studies of clay mineral samples were made from two mud volcanoes in the island of Trinidad. The mineral content and physical properties were compared with clay samples from the Lower Cruse and Nariva Formations through which the throats of the mud volcanoes are believed to have penetrated. Earlier studies suggested that the mud volcanoes formed either as a result of tectonic movement, accumulated gas pressure, or a combination of the two mechanisms. The thixotropic character of the clay may have greatly accelerated wither mechanism. Thixotropic clay saturated with water becomes a highly mobile fluid with great transporting power. Where such a mobile mass accumulates along a partly broken anticlinal structure, any release of pressure will occur upward. A gas pocket, tectonic squeeze, or both will provide pressure to maintain upward motion. In this way, the clay would be extruded to form a mud volcano. Although moving vertically and supported by gas and tectonic pressure, the clay flowage has characteristics comparable to horizontal clay movement in landslides where gas is not involved and motion is maintained by gravity. (Knapp-USGS)
W70-08280

ECOLOGICAL SURVEYS FROM SPACE.
National Aeronautics and Space Administration, Washington, D.C. Office of Technology Utilization.
For primary bibliographic entry see Field 07B.
W70-08465

DISTRIBUTION OF DOLOMITE IN A TIDAL FLAT ENVIRONMENT, SUGARLOAF KEY, FLORIDA,
Esso Production Research Co., Houston, Tex.
For primary bibliographic entry see Field 02L.
W70-08483

SETTLING VELOCITY OF GRAINS OF QUARTZ AND OTHER MINERALS IN SEA WATER VERSUS PURE WATER,
Geological Survey, Menlo Park, Calif.
Charles I. Winegard.
For sale by the Superintendent of Documents U.S. Government Printing Office, Washington, D.C. 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B161-B166, 1970. 6 p, 2 fig, 3 tab, 7 ref.

Descriptors: *Settling velocity, *Salinity, *Fresh water, *Sea water, *Particle size, Viscosity, Density, Mineralogy, Sedimentation, Deposition (Sediments), Quartz, Clay minerals.
Identifiers: US Geological Survey.

The settling velocities of particles in sea water differ significantly from those in fresh water. For example, a 10-micron-diameter quartz sphere in sea water will settle 4,000 meters in 882 days. The same particle in fresh water will settle to that depth in 824 days, 6.58 percent less time. Velocities in sea water can be calculated for a spherical particle of given size and composition if the viscosity and specific gravity of the water are known. (Knapp-USGS)
W70-08484

ANDERING OF THE ARKANSAS RIVER ICE 1833 NEAR BENT'S OLD FORT, LORADO,
ological Survey, Denver, Colo.
primary bibliographic entry see Field 02E.
0-08490

NDBAR DEVELOPMENT AND MOVEMENT AN ALLUVIAL CHANNEL RIO GRANDE AR BERNARDO, NEW MEXICO,
ological Survey, Albuquerque, N.M.
. Culbertson, and C. H. Scott.
sale by the Superintendent of Documents, US vernment Printing Office, Washington, DC, 02 - Price $3.25. In: Geological Survey earch 1970, Chapter B, US Geological Survey fessional Paper 700-B, p B237-B241, 1970. 5 p, g, 5 ref.

scriptors: *Alluvial channels, *Rio Grand, *New xico, *Sedimentary structures, *Sediment trans- t, Channel morphology, Dunes, Ripple marks, d waves, Sand bars, Regime, Scour, Deposition diments), Particle size, Sands.
ntifiers: Sorting (Sediments).

ic sounder records were used to document the elopment and movement of transverse bars in Rio Grande conveyance channel near Bernar- N. Mex. Rate of movement was about 350 and feet per day for two transverse bars observed. oth of flow was less and velocity of flow was ater over the bars than in the dune reaches, but water-surface slopes were equal. Median size of l-surface material on the backs of bars was finer n the bed-surface material in the dune reaches. e mechanics of formation and movement of nsverse bars is obscure; however, the bars may formed by the coalescence of large dunes, and vement is caused by scour of the bar at the up- eam end and deposition at the downstream end. natural sorting of bed material at the upstream l of the bar is also indicated. (Knapp-USGS)
0-08495

ALUATION OF A METHOD FOR ESTIMAT- G SEDIMENT YIELD,
ological Survey, Denver, Colo.
nn M. Shown.
r sale by the Superintendent of Documents, US vernment Printing Office, Washington, DC, 402 - Price $3.25. In: Geological Survey earch 1970, Chapter B, US Geological Survey ofessional Paper 700-B, p B245-B249, 1970. 5 p, g, 2 tab, 10 ref.

scriptors: *Sediment yield, *Estimating, *Small tersheds, Reservoir silting, Geology, Soil proper- s, Climates, Runoff, Topography, Vegetation ef- ts, Land use, Erosion, Channel erosion, Stream sion, Soil erosion, Sediment transport.
ntifiers: Sediment yield estimation.

method for estimating annual sediment yield, veloped by the Pacific Southwest Inter-Agency mmittee, was tested in 28 small watersheds rang- in size from 0.02 to 37 square miles. These tersheds for which hydrologic records exist are arid and semiarid areas of western Colorado, rth-central New Mexico, and east-central oming, and represent a variety of geologic, cli- tic, ecologic, and topographic conditions. Esti- tes of sediment yield correlated closely with liment yields measured in reservoirs, but the esti- tes were usually lower than the measured yields. e method was designed to make general sedi- nt classification for areas greater than 10 square les, but it also appears to work nearly as well for tersheds that are as small as 0.1 square mile. (K- pp-USGS)
0-08497

K. Chemical Processes

TOMATED POTENTIOMETRIC CHNIQUES FOR THE ON-SITE MONITOR- ING OF ANION CONCENTRATIONS IN WATER,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 05A.
W70-08156

NITRATE ION-SELECTIVE ELECTRODE IN MICROBIAL MEDIA,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 05A.
W70-08157

FLUORIDE ELECTRODE AS A REFERENCE IN THE DETERMINATION OF NITRATE ION,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 05A.
W70-08158

ION-SELECTIVE ELECTRODES FOR NITRATE ANALYSIS,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 05A.
W70-08159

LOW TEMPERATURE PRECIPITATION TITRATION OF PERCHLORATE AND TETRAFLUOROBORATE WITH TETRAPHENYLARSONIUM CHLORIDE AND ION-SELECTIVE ELECTRODES,
Missouri Water Resources Research Center, Columbia.
For primary bibliographic entry see Field 05A.
W70-08160

SULFIDE TO SULFATE REACTION MECHANISM--A STUDY OF THE SULFIDE TO SULFATE REACTION MECHANISM AS IT RELATES TO THE FORMATION OF ACID MINE WATERS.
Ohio State Univ. Research Foundation, Columbus.
For primary bibliographic entry see Field 05G.
W70-08161

AN EXAMPLE OF THE STUDY OF ISOTOPIC HYDROLOGY IN A SEMI-ARID REGION, THE BASIN OF LAKE CHAD (IN FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, Paris (France); United Nations Educational, Scientific and Cultural Organization, Paris (France). Office of Hydrology; and Groningen Rijksuniversiteit (Netherlands). Natuurkundig Laboratorium
H. Faure, J. Ch. Fontes, C. E. Gischler, W. G. Mook, and J. C. Vogel.
Journal of Hydrology, Vol 10, No 2, p 141-150, February 1970. 10 p, 1 fig, 14 ref.

Descriptors: *Hydrogeology, *Groundwater, *Surface-groundwater relationships, *Radioactivity techniques, *Radioactive dating, Groundwater movement, Deuterium, Tritium, Stable isotopes, Oxygen, Model studies.
Identifiers: Oxygen isotopes, Lake Chad Basin.

Study of water resources in the Lake Chad Basin, undertaken by UNESCO since 1966, consists of the preparation of a map of the entire basin, an analog model, and an examination of all previous studies. To verify and control existing data, a complementary isotopes study was made, including determinations of H-2, O-18, C-14, C-13 and tritium. The average rainfall at present feeding the aquifers in the Chad Basin has an O-18 content of -6 ppt relative to the SMOW standard. Because of evaporation the water of the Chari River, representing about 90% of the total input in the Lake Chad, becomes enriched in O-18 from about -4 ppt to +17 ppt at the northeast border areas of the lake. The groundwaters near Lake Chad generally have -4 to -7 ppt O-18. In the aquifers ages of over 40,000 years are found by C-14 analyses. Some groundwaters in the North of the Chad Basin with O-18 contents of -8 to -11 ppt suggest climatic conditions perceptibly different from the present climate, with lower temperatures and a higher relative humidity. (Knapp-USGS)
W70-08177

HYDROGEN ISOTOPIC FRACTIONATION OF WATER PASSING THROUGH TREES,
Geological Survey, Denver, Colo.; and Agricultural Research Service, Fort Collins, Colo.
R. L. Wershaw, Irving Friedman, S. J. Heller, and P. A. Frank.
In: Advances in Organic Geochemistry-1966, International Series of Monographs in Earth Sciences, Vol 32, Proceedings of 3rd International Conference on Organic Geochemistry, London, England, September, 1966, p 55-67, 1970. 13 p, 6 fig, 6 tab, 6 ref.

Descriptors: *Evapotranspiration, *Stable isotopes, *Deuterium, Transpiration, Evaporation, Circulation (Plants), Consumptive use, Spectrometers.
Identifiers: Mass spectrometry

Mass spectrometry was used to compare deuterium content in trees with that of the water sources used by the trees. The water in the leaves of a tree is enriched in deuterium with respect to the water in the phloem and the xylem of the tree which, in turn, are enriched in deuterium with respect to the groundwater beneath the tree. The enrichment in the leaves is apparently due to isotopic fractionation that takes place during transpiration, and the amount of fractionation is a function of the rate of transpiration from the tree; the transpiration rate is dependent upon temperature, relative humidity and solar radiation level. Two different processes have probably contributed to the enrichment of deuterium in the water in the phloem and xylem tissue: (1) movement of water from the leaves down into the trunk of the tree, and (2) enrichment of deuterium in the soil water surrounding the tree roots by evaporation. The isotopic composition of the water vapor coming from the soil should therefore be different from that of the water vapor from tree leaves, and it should, consequently be possible to calculate, by making a materials balance, the ratio of the amount of water evaporating from soil to the amount of water transpiring from leaves in a given area. (Knapp-USGS)
W70-08186

COLLIGATIVE PROPERTIES OF ANOMALOUS WATER,
Bristol Univ. (England). Dept. of Physical Chemistry.
For primary bibliographic entry see Field 01B.
W70-08189

SALTING COEFFICIENTS FROM SCALED PARTICLE THEORY,
Connecticut Univ., Storrs. Dept. of Chemistry.
For primary bibliographic entry see Field 01B.
W70-08191

STRUCTURES OF ALUMINUM HYDROXIDE AND GEOCHEMICAL IMPLICATIONS,
Geological Survey, Menlo Park, Calif
Robert Schoen, and Charles E. Roberson.
American Mineralogist, Vol 55, p 43-77, January-February 1970. 35 p, 11 fig, 2 tab, 54 ref.

Descriptors: *Geochemistry, *Mineralogy, *Clay minerals, *Crystal growth, *X-ray diffraction, Laterites, Soil formation, Bonding, Catalysts, Silicates, Weathering, Aluminum
Identifiers: *Gibbsite, *Bayerite, *Nordstrandite, *Aluminum hydroxide, Crystal chemistry, Bauxites.

Synthesis experiments in the alumina-water system at room temperature indicate that the gibbsite polymorph precipitates slowly from solutions whose pH is below the point of minimum solubility (pH 5.8), and the bayerite polymorph precipitates rapidly from solutions whose pH is above 5.8. Nordstrandite, the third polymorph of aluminum hydroxide, forms from bayerite during aging at intermediate to high pH values. In solutions of intermediate pH, both gibbiste and bayerite form, but with aging, early-formed gibbsite disappears as more bayerite forms. The extent of polarization by the aluminum cations determines whether the hydroxyl ions will possess cylindrical symmetry as in bayerite or tetrahedral symmetry as in gibbsite. It is suggested that the extent of polarization is inherited from the polarization in aqueous aluminum complexes. The usual abundance of the silicate ion in natural alkaline environments may explain the scarcity of nordstrandite, for the silicate ion may favor the precipitation of aluminosilicate minerals. Near absence of bayerite in nature may indicate that it is metastable and inverts to nordstrandite. (Knapp-USGS)
W70-08193

PALYNOLOGICAL TRACING OF SALINE WATER SOURCES IN LAKE KINNERET REGION (ISRAEL),
Hebrew Univ., Jerusalem (Israel). Dept. of Geology.
For primary bibliographic entry see Field 02H.
W70-08209

CARBON ISOTOPE FRACTIONATION DURING THE PRECIPITATION OF CALCIUM CARBONATE,
Heidelberg Univ. (West Germany). Physikalisches Institut.
K. Emrich, D. H. Ehhalt, and J. C. Vogel.
Earth and Planetary Science Letters, Vol 8, No 5, p 363-371, June 1970. 9 p, 2 fig, 3 tab, 16 ref.

Descriptors: *Stable isotopes, *Carbon, *Carbonates, *Bicarbonates, *Sea water, Chemical precipitation, Sedimentation, Carbon dioxide, Calcium carbonate, Tracers, Tracking techniques.
Identifiers: Isotopic fractionation, Carbon isotopes.

The fractionation of the carbon isotopes C-12 and C-13 in the equilibrium system CO2 (gas)-HCO3 (dissolved-CaCO3, solid) was measured at temperatures between 20 deg C and 60 deg C. The fractionation between solid carbonate and gaseous carbon dioxide is + (1.017 plus or minus 0.018)% at 20 deg C and the temperature dependence is - (0.0063 plus or minus 0.0008)%/deg C at 20 deg C. The corresponding fractionations between carbonate and bicarbonate (cb), and bicarbonate and carbon dioxide (bg) at 20 deg C are: cb, + (0.185 plus or minus 0.023)%, + (0.0035 plus or minus 0.0013)%/deg C; and bg, + (0.838 plus or minus 0.012)%, - (0.0109 plus or minus 0.0005)%/deg C. (Knapp-USGS)
W70-08232

BARIUM IN SEA WATER,
Lamont-Doherty Geological Observatory, Palisades, N Y.
K. Wolgemuth, and W. S. Broecker.
Earth and Planetary Science Letters, Vol 8, No 5, p 372-378, June 1970. 7 p, 6 fig, 3 tab, 14 ref. NSF Grant GA 1188.

Descriptors: *Water chemistry, *Sea water, *Trace elements, Sampling, Tracers, Radioisotopes, Stable isotopes, Analytical techniques, Radiochemical analysis.
Identifiers: Barium, Barium compounds, Isotope dilution analysis.

Vertical profiles of barium content were determined in the Atlantic and Pacific Oceans by the isotope dilution method. The Atlantic shows a range from 8 to 14 and the Pacific from 8 to 31 micrograms/liter (surface to deep water, respectively). Barium is incorporated into the remains of organisms in the surface ocean and released to the deep sea as the organic debris sinks toward the bottom. The greater surface to deep concentration increase observed in the Pacific is consistent with that found for other biologically active elements (Si, C, N, P, and others). The similarity of Ba and Ra profiles supports the expected chemical coherence between these elements. (Knapp-USGS)
W70-08233

RADIOISOTOPES IN WATERS OF NEOVOLCANIC REGIONS OF THE CAUCASUS,
Akademiya Nauk SSSR. Institut Geologii.
V. M. Kuptsov, V. V. Cherdyntsev, and V. L. Zverev.
Translated from Geokhimiya, No 9, p 1153-1155, 1969. Geochemistry International, Vol 6, No 5, p 919-922, 1969. 4 p, 2 tab, 5 ref.

Descriptors: *Radioisotopes, *Trace elements, *Groundwater, *Volcanoes, Magmatic water, Streams, Thermal water, Radium radioisotopes, Uranium radioisotopes, Radiochemical analysis.
Identifiers: Thorium, USSR, Caucasus.

Concentrations and ratios of U-238, U-234, Th-232, Th-228, Ra-226, and Rn were measured in waters from the Caucasus where volcanic activity occurred several thousand years ago. Low radium concentrations and Ra/U ratios suggest radium loss from the waters; high U/Rn ratios are attributed to lower diffusion rates from cold extrusives than from the heated rocks of areas of active volcanism. (Knapp-USGS)
W70-08261

GOLD IN THE MODERN SEDIMENTS OF THE NORTHERN PART OF THE ATLANTIC OCEAN BASIN,
G. N. Anoshin, E. M. Yemel'yanov, and G. A. Perezhogin.
Translated from Geokhimiya, No 9, p 1120-1129, 1969. Geochemistry International, Vol 6, No 5, p 897-905, 1969. 9 p, 6 fig, 4 tab, 16 ref.

Descriptors: *Gold, *Trace elements, *Bottom sediments, *Atlantic Ocean, Particle size, Sedimentation, Sedimentary rocks, Water chemistry, Sampling, Neutron activation analysis.
Identifiers: USSR.

Average gold contents in modern marine clastic sediments (1.3 ppb in the Atlantic Ocean, up to 6.0 ppb in the Black Sea) are close to the published averages for sedimentary rocks. The coquinoid limestones of the Black Sea are enriched in gold (up to 150 ppb), and elsewhere in the Atlantic basin biogenic limestones contain from 0.7 to 9.0 ppb of gold. There is a well defined positive correlation between the contents of gold and organic matter in the sediments. In clastic sediments, gold content increases with decrease in grain size, but this correlation is not observed in the biogenic sediments. (Knapp-USGS)
W70-08262

REMOBILIZATION OF PHOSPHATES AND MICRO-NUTRIENTS AND THEIR EFFECT ON THE PRODUCTION OF PLANKTON IN WATER CULTURES (IN GERMAN),
J. Clasen, and H. Bernhardt.
English summary. Archiv fur Hydrobiologie, Vol 65, No 4, p 528-538, 1969. 4 fig, 6 tab, 20 ref.

Descriptors: *Silts, *Phosphates, Sediments, Reservoirs, Rivers, Testing, Algae, Phytoplankton.
Identifiers: Soluble phosphate, Suspended particulates, Wahnbach River (Germany), Wahnbach Reservoir (Germany), Germany, Chlorella, Cryptomonas, Oscillatoria rubescens.

The suspended particulates of the River Wahnbach (Germany), largely silt, were separated by filtration and added in various amounts to flasks filled with river water or water from its terminal reservoir. The flasks were incubated in the dark, at rest, and under aerobic conditions for a fortnight. Subsequent analyses of water above the sediment revealed no change in phosphate concentration in flasks with river water, but a liberation of about 15% of phosphate from the silt in flasks with water of the reservoir. The difference is explained by a presumable state of equilibrium existing in phosphorus-rich river water and a deficiency of the element in water of the basin. Tank trials with water enriched in either silt or soluble phosphates and several species of algae failed to yield conclusive results. Some test organisms, particularly Chlorella spp, attained maximum density in cultures with soluble phosphates. Other algae (Cryptomonas spp) grew better in silt containing cultures. This effect is attributed to the presence of some unidentified growth-promoting ingredients in the silt, aside from the liberated phosphates. (Wilde-Wisconsin)
W70-08357

RECORDS OF WATER LEVELS AND CHEMICAL ANALYSES FROM SELECTED WELLS IN PARTS OF THE TRANS-PECOS REGION, TEXAS, 1965-68,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W70-08480

SPECTROCHEMICAL DETERMINATION OF MICROGRAM QUANTITIES OF GERMANIUM IN NATURAL WATER CONTAINING HIGH CONCENTRATIONS OF HEAVY METALS,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 05A.
W70-08496

QUANTITY AND CHEMICAL QUALITY OF LOW FLOW IN CIBOLO CREEK, TEXAS, MARCH 4-8, 1968,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W70-08509

DETERMINATION OF TOTAL NITROGEN, PHOSPHORUS AND IRON IN FRESH WATER BY PHOTO-OXIDATION WITH ULTRAVIOLET RADIATION,
Norsk Institutt for Vannforskning, Oslo.
For primary bibliographic entry see Field 05A.
W70-08513

GENERAL PROBLEMS IN THE THEORY OF IONIC HYDRATION IN AQUEOUS SOLUTIONS,
Akademiya Nauk SSSR, Moscow. Institut Obshchei i Neorganicheskoi Khimii.
For primary bibliographic entry see Field 01B.
W70-08518

STRUCTURE OF WATER IN CRYSTALLINE HYDRATES OF CERTAIN BIOLOGICALLY IMPORTANT COMPOUNDS,
Akademiya Nauk SSSR, Moscow. Institut Obshchei i Neorganicheskoi Khimii.
For primary bibliographic entry see Field 01B.
W70-08527

2L. Estuaries

SENSITIVITY OF BENTHIC MICROFLORA TO POLLUTION GRADIENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 05C.
W70-08164

METHOD FOR PREDICTING POLLUTANT RANSPORT IN TIDAL WATERS,
alifornia Univ., Berkeley. Hydraulic Lab.
or primary bibliographic entry see Field 05B.
70-08168

HE FLOOR OF CENTRAL SAN FRANCISCO AY,
eological Survey, Washington, D.C.
aul R. Carlson, Tau R. Alpha, and David S. cCulloch.
ineral Information Service, Vol 23, No 5, p 97-07, May 1970. 11 p, 7 fig, 2 map, 1 tab, 12 ref.

escriptors: *Bathymetry, *Topography, *Bottom diments, *Bays, Profiles, Mapping, Surveys, ides, Tidal effects, Scour, Erosion, Geomorpholo-, Sounding, Depth, Hydrography, Sand waves, ediment transport.
entifiers: *San Francisco Bay.

entral San Francisco Bay has a complex orphology that has resulted largely from stream rosion, which produced a highly irregular floor on e tectonically deformed bedrock, and from com-ex tidal circulation, which has generated currents at have simultaneously scoured deep modern annels and deposited sediment to produce exten-ve shoals. The wide range of energy environments at exists in the central bay is reflected in the grain ze and thickness of the unconsolidated sediment nd the morphology of the modern bay floor. Where current and wave-energy levels are low, ch as in Richardson Bay and the Berkeley mud ats, the resulting thick sequence of uncon-olidated sediment is predominantly silt and clay. s the amount of energy increases, the grain size ecomes larger and sand predominates, as it does ver most of the central bay. With increasing ener-, large sand waves are formed on the bottom, and the highest energy environments, such as eneath the Golden Gate Bridge, the bedrock ap-ears to be swept clean of sediment. The thickness f sediments as shown on acoustic subbottom rofiles varies from none over bedrock knobs and he flanks of the islands to more than 250 feet in arts of the central bay. (Knapp-USGS)
70-08181

STUDY OF THE DYNAMICS OF SUSPENDED ATTER BY MEANS OF NATURAL RADIOAC-IVE TRACERS: AN APPLICATION TO THE IRONDE ESTUARY,
aris Univ., Thonon-les-Bains (France). Center for eodynamic Research; and National Hydrological ab., Chatou (France).
M. Martin, M. Meybeck, and M. Heuzel.
edimentology, Vol 14, No 1-2, p 27-37, April 970. 11 p, 7 fig, 7 ref.

escriptors: *Suspended load, *Tracers, Radioactivity techniques, *Instrumentation, stuaries, Rivers, Sediment transport, Sediments, rovenance, Sediment load, Turbidity, Potassium adioisotopes, Tracking techniques.
dentifiers: Gironde Estuary (France)

he determination of the natural radioelements in uspended matter in rivers and estuaries lead to a imple exponential relation between gamma activi-y and turbidity. A new turbidimetry method is ased on this relation. In situ measurements have een conducted with field gamma scintillometers nd compared with different turbidimetry methods, uch as nephelometry, gravimetry and gamma ray bsorptiometry. This method has been particularly onvenient to continuous in situ measurements of urbidity from 0.5 to several hundreds of g/liter. his broad range is very well adapted to turbidity tudies in estuaries. The new method was applied to tudy suspended matter dynamics in the Gironde stuary (France) during November 1968, as a part f a more general study of natural radioactivity in errigenous sediments brought into the ocean. (K-app-USGS)
W70-08195

THE SEDIMENTS AND SEDIMENTARY PROCESSES OF THE EASTERN MISSISSIPPI CONE, GULF OF MEXICO,
Florida State Univ., Tallahassee. Dept. of Geology.
Ter-Chien Huang.
Florida State University Sedimentology Research Laboratory Contribution No 31, December 1969. 124 p, 11 fig, 6 tab, 114 ref, append.

Descriptors: *Bottom sediments, *Deltas, *Mississippi River, *Sedimentary structures, *Sedimentary rates, Turbidity currents, Silts, Clays, Deposition (Sediments), Sediment distribution, Sediment transport, Gulf of Mexico.
Identifiers: Mississippi Cone.

Sedimentary processes on the eastern Mississippi Cone were interpreted from sedimentary structures, textures, and compositions as well as from bathymetry, bottom photographs and continuous seismic profiles of the deep-sea fan. Twenty-nine piston cores and 25 gravity cores show that the sediments consist of a repetitious vertical succession of gray silts and silty clays intercalated with occasional layers of fine sand. Each core is topped by a 20 to 50 cm layer of yellowish brown foraminiferal clay. Disequilibrium age determinations indicate that the lower silty layers, representing the deposits of latest low sea level stands, were deposited more rapidly than the upper foraminiferal clays. These sedimentation rates depend primarily on the rate of the detrital influx and sea level change and average about 30 cm/1000 years. The primary mechanisms of sediment transport are differential pelagic settling and low-flow regime bottom currents, with mass movements by sliding or slumping common in channel and slope areas. (Knapp-USGS)
W70-08200

GRAIN-SIZE IMAGE OF CLASTIC DEPOSITS,
For primary bibliographic entry see Field 02J.
W70-08204

A MARYLAND COASTAL AQUIFER,
Maryland State Geological Survey, Baltimore.
Harry J. Hansen.
Journal American Water Works Association, Vol 62, No 5, p 286-292, May 1970. 7 p, 8 fig, 2 tab, 10 ref.

Descriptors: *Water management (Applied), *Model studies, *Decision making, *Atlantic Coastal Plain, *Aquifers, Groundwater, Groundwater movement, Planning.
Identifiers: Groundwater zoning models.

A managerial model based on the zoning concept is outlined for use with areally extensive artesian aquifers occurring in several layers; artesian aquifers of this description characterize the Coastal Plain states from New Jersey to Texas. The model is inapplicable to water-table situations. It assumes humid-area conditions in which precipitation is not so important a limiting factor as the permeability and thickness of the aquifer, the hydraulic gradient between the artesian aquifer and its outcropping recharge belt, and the amount of leakage occurring through confining beds. Applying field data, each of the major artesian aquifers occurring beneath Southern Maryland and the Eastern Shore are subdivided into several user categories. To illustrate this procedure, discussion is focused initially on a specific formation---the Aquia Aquifer. (Knapp-USGS)
W70-08227

BARIUM IN SEA WATER,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 02K.
W70-08233

CURRENT WATER QUALITY CONDITIONS AND INVESTIGATIONS IN THE UPPER POTOMAC RIVER TIDAL SYSTEM,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05B.
W70-08248

PRELIMINARY ANALYSES OF THE WASTE WATER AND ASSIMILATION CAPACITIES OF THE ANACOSTIA TIDAL RIVER SYSTEM,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05A.
W70-08249

LITHIFICATION OF DEEP SEA SEDIMENTS BY PYRITE,
Duke Univ., Durham, N. C. Dept. of Geology; and Duke Univ., Beaufort, N. C. Marine Lab.
Michael E. Field, and Orrin H. Pilkey.
Nature, Vol 226, p 836-837, May 30, 1970. 2 p, 3 fig, 7 ref.

Descriptors: *Lithification, *Sediments, *Pyrite, *Continental shelf, Atlantic Ocean, North Carolina, Core drilling, Diagenesis.
Identifiers: *Hatteras Outer Ridge, *Hatteras Canyon System.

Unique pyrite-cemented silty sand layers have been found in three out of 35 piston cores taken from the North Carolina lower continental rise at depths from 4,770 to 4,950 m. The layers are approximately 0.5 cm thick and consist mainly of terrigenous grains in a cement identified as pyrite by X-ray diffraction analysis. None of the precursor iron sulfides commonly associated with sedimentary pyrite were found. The pyritized layers are geologically significant because they must play a part in restricting and channeling vertical exchange between seawater and sediment as well as in interstitial water reactions and migrations. Although the layers are thin and volumetrically unimportant in the local sediment column, the occurrence is of great interest because such cementation by pyritization is one of only two known mechanisms of lithification in the uppermost portions of deep sea sediments. (Woodard-USGS)
W70-08250

VARIABLE BOUNDARY, TWO DIMENSIONAL TIDAL MODEL,
Alaska Univ., College. Inst. of Marine Science.
J. B. Matthews, and J. C. H. Mungall.
Nature, Vol 226, p 835-836, May 30, 1970. 2 p, 2 fig, 4 ref.

Descriptors: *Estuaries, *Mathematical models, *Currents (Water), *Tides, *Computer programs, Digital computers, Profiles, Model studies, Tidal waters.
Identifiers: *Variable boundary tidal model.

A two dimensional program which can be used to solve semidiurnal tidal problems in estuaries is described. The mathematical basis for the analysis is derived from a two-dimensional explicit model originally developed for the North Sea, using the North Sea model's basic differential equations, equations of motion in two horizontal dimensions, and the equation of continuity. Solution of the equations, by finite difference methods, is facilitated by a grid layout and is staggered in time and space. The grid can be terminated at alternate lines in both directions to represent either open or closed boundaries. An integer control matrix is built in the computer from separate linear integer matrices for each row and column of the grid. The input is by punched card. The model has been applied to several examples, both theoretical and practical, with excellent results. (Woodard-USGS)
W70-08252

A LAGRANGIAN METHOD FOR PREDICTING POLLUTANT DISPERSION IN BOLINAS LAGOON, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 05B.
W70-08254

MODELLING OF SEDIMENT MOTIONS OFFSHORE,
Asian Institute of Technology, Bangkok (Thailand). Dept. of Engineering.
Richard Silvester.
Text also in French. Journal of Hydraulic Research, Vol 8, No 2, p 229-259, 1970. 31 p, 9 fig, 38 ref.

Descriptors: *Hydraulic models, *Sediment transport, *Waves (Water), *Bed load, Unsteady flow, Continental shelf, Beaches, dunes, Ripple marks, Mass transfer, Suspended load, Flumes, Currents (Water), Littoral drift, Erosion.
Identifiers: Wave modeling.

Water particle motion at the sea bed beyond the breaker line is essentially a linear oscillation along the line of wave advance for a single wave train. When two wave trains are angled to each other, the resultant motion varies from linear in two directions to elliptical and circular in a horizontal plane. The techniques used to study sediment transport in the offshore zone are discussed and a new modeling concept is introduced. A block or mass of water is oscillated in a flume, superimposing oscillatory motion on steady flow. The most realistic replication of wave motion in the deeper zones of the Continental Shelf should include angled wave trains. The principle of the 'water block' could be extended for this purpose. A cylindrical box with vertical axis and open bottom could be oscillated in two mutually perpendicular directions. (Knapp-USGS)
W70-08256

GOLD IN THE MODERN SEDIMENTS OF THE NORTHERN PART OF THE ATLANTIC OCEAN BASIN,
For primary bibliographic entry see Field 02K.
W70-08262

ECOLOGICAL SURVEYS FROM SPACE.
National Aeronautics and Space Administration, Washington, D.C. Office of Technology Utilization.
For primary bibliographic entry see Field 07B.
W70-08465

ESTUARINE RADIOECOLOGY - A BIBLIOGRAPHY OF REPORT LITERATURE,
Department of the Interior, Washington, D.C. Office of Library Services.
For primary bibliographic entry see Field 10.
W70-08470

DISTRIBUTION OF DOLOMITE IN A TIDAL FLAT ENVIRONMENT, SUGARLOAF KEY, FLORIDA,
Esso Production Research Co., Houston, Tex.
D. K. Atwood, and J. N. Bubb.
Journal of Geology, Vol 78, No 4, p 499-505, July 1970. 7 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Dolomite, *Carbonate rocks, *Diagenesis, *Water chemistry, *Tidal marshes, Shallow water, Florida, Sampling, Salinity, Calcium, Magnesium, Sea water, Tides.
Identifiers: Tidal flats, Sugarloaf Key (Fla).

A study of modern tidal flats on Sugarloaf Key, Florida, has been made to determine distribution of penecontemporaneous dolomite, the presence of which was previously reported by Shinn. Dolomite occurs in a crust at or near the surface of Recent tidal flat sediments and in lesser amounts in unconsolidated sediments. The greatest concentration of dolomite is near the shoreline and within topographic lows on the flats, that is, areas where sediments are most frequently wet by tides. The dolomite concentration decreases toward interior and higher portions of the flats, and essentially no dolomite was found in adjacent bays. Interstitial waters expressed from Recent sediments on the flats were analyzed at different times in the year and found to be near sea water in salinity and chemistry. This combination of dolomite distribution and interstitial water data suggests that dolomitization is occurring with waters near sea water in composition. (Knapp-USGS)
W70-08483

SETTLING VELOCITY OF GRAINS OF QUARTZ AND OTHER MINERALS IN SEA WATER VERSUS PURE WATER,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02J.
W70-08484

DOSAGE REQUIREMENTS FOR SLUG INJECTIONS OF RHODAMINE BA AND WT DYES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-08498

A TEST OF FLUSHING PROCEDURES TO CONTROL SALT-WATER INTRUSION AT THE W. P. FRANKLIN DAM NEAR FT. MYERS, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 05G.
W70-08516

THE MAGNITUDE AND EXTENT OF SALT-WATER CONTAMINATION IN THE CALOOSAHATCHEE RIVER BETWEEN LA BELLE AND OLGA, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 05B.
W70-08517

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

INVESTIGATION OF THE FEASIBILITY OF PURIFYING MUNICIPAL WASTE WATER BY DISTILLATION,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05D.
W70-08431

A STUDY OF WATER PLANT ISOLATION FROM CONTAMINATION,
National Nuclear Corporation, Palo Alto, Calif.
Frederick E. Crever.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC, 20402 - Price $1.50. Office of Saline Water Research and Development Progress Report No 526, October 1969. 147 p, 16 fig, 37 tab, 15 ref, 3 append. OSW Contract No 14-01-0001-2192.

Descriptors: *Desalination processes, *Water pollution control, *Design, *Nuclear engineering, Nuclear reactors, Nuclear wastes, Radioactive wastes, Costs, Cost analysis, Systems analysis.
Identifiers: Contamination control.

Potential concentration of radioactive nuclides in the water plant brine, effluent, and product water were determined for dual purpose power generation and desalting plants using nuclear steam supply systems. The nuclear steam supply systems considered were those using the light water-cooled and moderated reactors. The direct cycle system using the boiling water reactor, and the pressurized water reactor using the indirect cycle were both considered. A design basis was studied for a pressurized, demineralized water loop to be inserted between the heating steam from a nuclear steam supply and the brine in a multistage flash sea water desalting plant to allow extended operation at full capacity with brine heater leakage. The loop is to be pressurized to about 10 psi above both the heating steam and the brine so that any leakage that occurs in the heat exchangers would be either into the nuclear steam supply system or into the water plant brine. The leakage would be pure water, which would not be harmful to either the steam supply system or the water plant. A design basis was also studied for an isolating loop using steam as the working fluid between a nuclear steam supply and a multistage flash sea water distillation plant. With horizontal brine heaters, the steam temperature would have to be raised to 273 deg F which would give a steam pressure of 43.8 psia in order to insure steam pressure above brine pressure at all points of potential leakage. (Knapp-USGS)
W70-08504

REPORT ON DIFFERENTIAL THERMAL AND THERMOGRAVIMETRIC ANALYSIS,
Wrightsville Beach Test Facility, N.C.
John R. Newton, and M. E. Atkins.
For sale by the Superintendent of Documents, US Government Printing Office, Wash, DC, 20402 - Price $1.00. Office of Saline Water Research and Development Progress Report No 514, December 1969. 99 p, 75 fig, 20 ref.

Descriptors: *Scaling, *Chemical analysis, *Differential thermal analysis, *Gravimetric analysis, *Distillation, Desalination processes, X-ray analysis.
Identifiers: Thermogravimetric analysis.

The need for analytical data pertaining to the composition of scales from distillation plants resulted in an evaluation of differential thermal analysis (DTA) and thermogravimetric analysis (TGA). The data obtained by DTA-TGA can be easily interpreted. X-ray methods will qualitatively identify trace compounds which may not be detected by DTA-TGA. X-ray and TGA methods provide quantitative results; however, TGA provides a more accurate quantitation of major constituents with less time spent in interpretation and little, if any, standard analyses required. (Knapp-USGS)
W70-08507

THEORY OF LIQUIDS,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 01A.
W70-08510

DEVELOPMENT OF MODIFIED POLYOLEFIN MEMBRANES FOR REVERSE OSMOSIS,
Southwest Research Inst., San Antonio, Tex.
H. F. Hamil, and W. W. Harlowe, Jr.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $0.65. US Office of Saline Water Research and Development Progress Report No 530, June 1970. 58 p, 9 fig, 22 tab, 2 ref. OSW Contract No 14-01-0001-2129.

Descriptors: *Desalination processes, *Reverse osmosis, *Permselective membranes, *Plastics, *Laboratory tests, Permeability, Ion transport, Semipermeable membranes.
Identifiers: Grafted polyethylene membranes.

Procedures were studied for the radiation-induced grafting of polyethylene film to yield a variety of modified polyethylene membranes. Modification of the polyethylene was accomplished by grafting with acidic monomers such as aminoalkyl methacrylates and vinylpyridines, and neutral monomers such as hydroxyalkyl methacrylates. Some graft ter polymers were prepared by incorporating relatively hydrophobic monomers such as acrylonitrile

rylamide, or vinyl acetate into the grafting solu-
n along with acrylic acid. Crosslinking during
fting was accomplished by use of difunctional
onomers in the grafting solution. The membranes
produced maintained much of the tensile
ength and elongation of the original
lyethylene. The acid- and base-grafted films
re hydrophilic, particularly as the potassium and
drochloride salts. The hydrophilicity of such
embranes was reduced by crosslinking or by
grafting with a hydrophobic monomer. The
utral membranes appeared to be relatively im-
rmeable to water. (Knapp-USGS)
70-08514

**NTHESIS OF MODIFIED LOEB MEM-
RANES BY GRAFTING,**
lymer Research Corp. of America, Brooklyn,
Y.
rl Horowitz.
r sale by Superintendent of Documents, US
overnment Printing Office, Wash, DC, 20402 -
ce $0.50. US Office of Saline Water Research
d Development Progress Report No 545, June
70. 41 p, 1 fig, 16 tab. OSW Contract No 14-01-
01-1322.

escriptors: *Desalination processes, *Reverse os-
osis, *Permselective membranes, *Laboratory
ts, *Permeability, Ion transport, Cellulose.
entifiers: Grafted membranes, Loeb membranes,
llulose acetate membranes.

large number of monomers were grafted and
emically attached to the cellulose acetate
olecules of Loeb membranes for reverse osmosis,
th subsequent growth of polymeric side chains of
e monomer. The grafting of nonpolar monomers
ve no improvement in either water flux or salt re-
tion efficiency. Strongly polar monomers, espe-
lly positively charged quaternaries, substantially
creased the water flux without loss in salt rejec-
n efficiency. The polar charge of the grafted
ains may orient the dipole molecule of water and
crease its transport rate. Grafting on completely
epared membranes gave results that were
oducible and uniform, and permitted meaning-
comparison with reference membranes. (K-
pp-USGS)
70-08515

3B. Water Yield Improvement

**EVELOPMENT AND EVALUATION OF
ATER HARVESTING SYSTEMS,**
izona Water Resources Research Center, Tuc-
n.
rwin B. Cluff, Gordon R. Dutt, Martin M. Fogel,
d Lorne G. Wilson.
vailable from the Clearinghouse as PB-192 763,
.00 in paper copy, $0.65 in microfiche. Project
mpletion Report, December 1969. 28 p, 7 fig, 2
, 6 ref. OWRR Project A-001-ARIZ (6).

escriptors: *Water Harvesting, *Water Yield Im-
ovement, Water storage, Underground water
rage, Water conservation, Waterproofing, Sur-
e sealing, Stock water, *Evaluation, Recharge
lls, Injection wells.

ater harvesting systems were developed and eval-
ted. These systems consisted of gravel covered
astic and sodium-treated catchments with plastic-
ed, butyl-covered storage tanks and un-
rground storage into unused aquifers through ar-
icial recharge. A plastic-laying gravel spreader
at attaches to a dump truck was developed and
ed to install a one-half acre gravel covered plastic
tchment. The catchment supplies water to a
0,000-gallon capacity storage tank which is lined
th 6-mil polyethylene plastic and covered with a
tyl rubber cover. Field tests using sodium
loride were conducted on 8 X 16 and one acre
ts. These tests indicate that the sodium chloride
atment does reduce the infiltration rate on sandy
m soils. The overall increase for the year follow-
ing treatment was approximately 35 per cent. Field tests made using a recharge pit and a recharge well indicated that for small quantities of harvested, sediment free water, the recharge well would be recommended for injection into underground storage, substantial water quality changes could occur in percolating water when using the recharge pit. The same injection well could be used to recover the recharged waste. (Cluff-University of Arizona)
W70-08153

INFLUENCE OF CONTOUR TRENCHING ON SNOW ACCUMULATION,
Forest Service (USDA), Ogden, Utah. Intermountain Forest and Range Experiment Station.
Robert D. Doty.
Journal of Soil and Water Conservation, Vol 25, No 3, p 102-104, May-June, 1970. 3 p, 6 fig, 1 tab, 2 ref.

Descriptors: *Snow management, *Water conservation, *Vegetation effects, *Contour furrows, *Trenches, Snow cover, Water yield improvement, Utah, Land management, Soil conservation.
Identifiers: Contour trenching.

Contour trenches for watershed rehabilitation in Utah were evaluated with regard to their effect on snow accumulation. The trenches studied are on a windswept southwest exposure where snow redistribution by wind is important. Trenches increased snow accumulation slightly, which appeared to be more significant to revegetation than to water yield. (Knapp-USGS)
W70-08185

SNOW HYDROLOGY OF THE PRAIRIE ENVIRONMENT,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
For primary bibliographic entry see Field 02C.
W70-08241

SNOW STORAGE DISTRIBUTION IN RIVER BASINS,
For primary bibliographic entry see Field 02C.
W70-08268

CONDENSATION AS A MECHANISM FOR WATER GAIN IN NOCTURNAL DESERT POIKILOTHERMS,
California Univ., Los Angeles Dept. of Zoology.
Robert C. Lasiewski, and George A. Bartholomew.
National Science Foundation research grants GB-5347 and 6B-5139. Copeia, No 2, p 405-407, August 31, 1968. 1 fig, 1 tab, 8 ref.

Descriptors: *Xerophilic animals, *Condensation, *Microenvironment, *Moisture availability, Relative humidity, Dew point, Animal physiology, Toads, Reptiles, Physiological ecology, Water balance, Arid lands.
Identifiers: *Poikilotherms, *Fossorial animals, Spiders.

Four nocturnal, fossorial, and poikilothermic desert-dwelling animals - a banded gecko, trantula, and two species of spadefoot toads - were cooled for 30 minutes at 15 deg centigrade and 90-100 percent relative humidity. Each was subsequently transferred to a weighing chamber at 30-32 deg centigrade and 85-92 percent relative humidity. Each animal gained weight as a result of water condensation on its body surfaces. The amount condensing varied directly with body size but bore no relation to body weight. Desert subsoil temperatures in the summer are fairly uniform and often greater than 30 deg centigrade. Humidity in the burrows may be quite high in contrast to the outside. The body temperature of a nocturnal poikilotherm moving about on the ground surface may drop 10-15 deg, creating the necessary conditions for condensation upon reentry into the warm, humid burrow. Whether such condensation could yield physiologically useful water cannot be answered in the absence of data on water turnover rates in desert poikilotherms. It is stressed that these experiments indicate that such condensation could occur in nature, but it is not implied that it actually does. (Casey-Arizona)
W70-08344

HYDROGEOLOGY OF THE UPPER SILVER BOW CREEK DRAINAGE AREA, MONTANA,
Montana Bureau of Mines and Geology, Butte.
For primary bibliographic entry see Field 02F.
W70-08463

DESIGN FLOOD DETERMINATION IN SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-08464

OBJECTIVES, METHODS, AND ENVIRONMENT--GILA RIVER PHREATOPHYTE PROJECT, GRAHAM COUNTY, ARIZONA,
Geological Survey, Washington, D.C.
R. C. Culler, D. E. Burkham, M. R. Collings, E. S. Davidson, and R. L. Laney.
For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $0.45. US Geological Survey Professional Paper 655-A, 1970. 25 p, 10 fig, 29 ref.

Descriptors: *Hydrologic budget, *Evapotranspiration, *Phreatophytes, *Arizona, Energy budget, Water balance, Streamflow, Groundwater, Evaporation, Transpiration, Alluvial channels, Water supply, Water resources development, Water conservation.
Identifiers: Gila River Phreatophyte Project.

The most obvious need in phreatophyte-control research is evaluation of water conservation on a flood plain typical of many areas of existing and proposed application. Hydrologic and ecologic variables must be defined by the evaluation so that the data may be applied to other sites. A 24-kilometer (15-mile) reach of the Gila River flood plain in the San Carlos Indian Reservation was divided into three subreaches. About 2,400 hectares are covered by phreatophytes, principally saltcedar and mesquite. Phreatophyte removal was started in 1966. Postclearing measurement will extend to July 1972. A water budget includes surface and subsurface inflow and outflow in the Gila River and its tributary inflow to the reach, precipitation on the flood plain, and changes in groundwater storage in the saturated and unsaturated zones of the study reach. The vegetation, chemical quality of water, sedimentation, and climate also are being studied. The water budget is the basic method of evaluation. All data are being collected for analysis by digital computer. (Knapp-USGS)
W70-08467

PRECIPITATION, STREAMFLOW, AND MAJOR FLOODS AT SELECTED SITES IN THE GILA RIVER DRAINAGE BASIN ABOVE COOLIDGE DAM, ARIZONA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-08468

WINDS OVER SALTCEDAR,
Geological Survey, Lubbock, Tex.
For primary bibliographic entry see Field 02D.
W70-08469

FOREST HYDROLOGY RESEARCH IN WATERSHED MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Forest Hydrology and Watershed Management.
For primary bibliographic entry see Field 04D.
W70-08474

ENERGY BALANCE ESTIMATES OF EVAPOTRANSPIRATION,
Oregon State Univ., Corvallis. Dept. of Forest Climatology.
For primary bibliographic entry see Field 02D.
W70-08477

MAJOR UNITED STATES WATER PROBLEMS ALONG THE INTERNATIONAL BOUNDARY REACH OF THE RIO GRANDE (BRAVO),
International Boundary and Water Commission, El Paso, Tex. Office of Water Control.
Ted E. Henderson.
In: International Water Law Along the Mexican-American Border, Committee on Desert and Arid Zone Research, Southwestern and Rocky Mountain Division, A.A.A.S., No 11, p 26-36, 1968. 2 fig, 5 ref.

Descriptors: *Texas, *Rio Grande, *International Boundary and water commission, Water supply, Water control, Water quality, Dams, Flood control, Reservoirs.
Identifiers: *Mexico.

Since the water treaty of 1944 between the U.S. and Mexico, the major Rio Grande water problems in the U.S. have been: (1) Regulation and usage (2) Water quality (3) Water supply (4) Flood damage. The river flow is now largely regulated by dams and the remaining problems are only those of adjudicating Texas water rights and improving irrigation practices. In the areas of major usage, supply problems exist or are anticipated in the El Paso, Maverick and Lower Rio Grande areas where demands are rapidly increasing. The principle quality problem is salt accumulaton on both the American and Mexican sides, resulting from shortage of water for leaching salts. Although efforts are being made, a final solution will be achieved only by additional water from the outside. Water from desalinization will probably be a major factor sometime in the future. Current construction plans, when realized, will probably eliminate flood damage. (Casey-Arizona)
W70-08539

3C. Use of Water of Impaired Quality

RELATIONSHIPS BETWEEN CERTAIN INDICES OF SALINE WATER IRRIGATED SOILS OF WESTERN RAJASTHAN,
Central Arid Zone Research Iast., Jodhpur (India); and Indian Grassland and Fodder Research Inst., Jhansi (India). Div. of Soil Science and Agronomy.
For primary bibliographic entry see Field 02G.
W70-08347

PEANUT RESPONSE TO UNIFORM AND NON-UNIFORM SOIL SALINITY,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
J. Shalhevet, P. Reiniger, and D. Shimshi.
Agronomy Journal, Vol 61, No 3, p 384-387, May-June 1969. 3 fig, 3 tab, 5 ref.

Descriptors: *Peanuts, *Saline soils, *Plant growth, *Crop response, *Crop production, Arid lands, Irrigation, Evapotranspiration, Adsorption, Germination, Growth stages, Seeds, Plant physiology, Salinity, Salt tolerance, Soil profiles.
Identifiers: *Soil salinity, *Water uptake, Israel.

Peanuts grown in artificially salinized plots showed a 50 percent yield reduction at an EC sub e of 4.7 mmhos/cm and a 20 percent reduction at an EC sub e of 3.8 mmhos/cm. As long as there was equal mean soil salinity, the shape of the soil salinity profile did not affect yield reduction. As salinity increased, total ET decreased, but it would appear that the reduction in water uptake resulting from increased soil salinity was the consequence of reduced growth rather than the cause of it. The decrease in ET efficiency at high salinity levels was due not to transpiration, but to evaporation from plots having an incomplete plant cover. Salt tolerance was higher during germination than during any subsequent growth stage. At an EC sub e of 13 mmhos/cm a 50 percent reduction in germination was obtained. There was a similar 50 percent reduction in seedling development at an EC sub e of 7.2 mmhos/cm. (Carr-Arizona)
W70-08521

3D. Conservation in Domestic and Municipal Use

MCFEETERS V PARKER (ADMINISTRATIVE AGENCY'S CONTROL OVER PUBLIC UTILITIES).

30 A2d 300-305 (Vt 1943).

Descriptors: *Vermont, *Water supply, *Pipes, *Administrative agencies, Eminent domain, Judicial decisions, Legal aspects, Water demand, Conduits, Legislation, Public utilities, Public health, Water distribution (Applied), Consumptive use, Water conveyance, Distribution systems, Pumping plants, Public benefits.

Defendant operated a water system pursuant to plaintiff Public Service Commission sactions, serving the general area as a public utility. After supplying water for a number of years to plaintiff's property, defendant's supply to that property was terminated without the prior permission of the Commission. The Commission had later ordered defendant to furnish the property with a supply of water after finding that the continuance of the service was necessary for the safety, convenience and accomodation of the public. Defendant was also ordered to repair all pipelines and appliances necessary to bring a water supply to the property. Plaintiffs petitioned for a writ of mandamus to enforce these orders. Defendant answered by challenging the constitutional authority of the Commission. The court held that defendant's system had an adequate supply of water and that there would be no financial difficulty in restoring service to plaintiff's property. The court held further that the Commission's order was within its statutory and constitutional powers of general supervision over companies engaged in the sale and distribution of water for domestic purposes. (Barnett-Florida)
W70-08522

PETITION OF NEW YORK WATER SERVICE CORP (REVIEW OF ADMINISTRATIVE ORDER DENYING APPROVAL OF SHALLOW WELL CONSTRUCTION).
283 NY 23, 27 NE2d 221-225 (1940).

Descriptors: *New York, *Saline water intrusion, *Administrative decisions, *Shallow wells, Cities, Municipal water, Wells, Groundwater, Water consumption, Water supply, Water quality, Water pollution sources, Well regulations, Administrative agencies, Adjudication procedure, Judicial decisions, Legal aspects, Civil engineering, Water works, Urbanization, Water policy, Population, Chlorine, Well permits, Drawdown.

Petitioner was a private water company which was the sole supplier of water to a large part of Brooklyn. Due to the intrusion of chlorine, sand and salt into various underground sources, petitioner's daily yield from these sources had decreased over a period of years. In the same period population had gradually increased in the area petitioner served. Petitioner applied to defendent Water Power and Control Commission for approval of a plan to construct and temporarily operate four wells of shallow depth until a new source could be obtained from another water development project. The Commission denied the application on the grounds that public necessity did not justify use of new wells and that their construction could increase salt-water intrusion into the area. Petitioner appealed to the court for review. The court found that defendant's contentions did not rest on such adequate findings of fact as would enable parties or a court to determine whether the decision followed as a matter of law. Further, petitioner had not been allowed to cross-examine defendant's investigating engineer concerning his conclusions. The court remanded the proceedings to the Commission with instructions to make findings of fact. (Hubener-Florida)
W70-08563

CITY OF SPRINGDALE V FLEMING (ENFORCEMENT OF CONTRACT TO SUPPLY WATER).
89 SW2d 602-603 (Ark 1936).

Descriptors: *Arkansas, *Easements, *Usufructuary right, *Contracts, Cities, Pipes, Water conveyance, Water conservation, Water costs, Water delivery, Water distribution (Applied), Water supply, Drains, Reasonable use, Irrigation, Cavitation, Consumptive use, Irrigation water, Domestic water, Conduits, Judicial decisions, Legal aspects, Springs.

Plaintiff contracted with and coveyed to defendant city a tract of land upon which was located a spring. Plaintiff also gave an easement over an additional tract he owned to allow defendant to lay water mains. As consideration for these transfers, defendant agreed to furnish plaintiff with free water for domestic, yard and stock watering purposes. Plaintiff received free water until defendant disconnected the water supply, alleging plaintiff's abuse of the privilege by using water for commercial, irrigation, and purposes other than as comtemplated in the contract. Plaintiff brought action for a mandatory injunction to enforce the contract. Defendant appealed from a lower court holding for plaintiff. On appeal, defendant alleged: (1) that the contract was void since it failed to comply with an applicable statute; and (2) that the right of the city to acquire a water source and an easement to lay its water mains was ultra vires. The court held that it was immaterial whether the water supply was acquired in conformity with the statute. Defendant could not retain the spring and easement without continuing to pay the agreed upon consideration, which was the free use of water by plaintiff. (Barnett-Florida)
W70-08564

NEW YORK WATER SERV CORP V WATER POWER AND CONTROL COMM'N OF DEP'T OF CONSERVATION OF NEW YORK (EXCESSIVE DELEGATION OF POWER TO DETERMINE NECESSITY FOR WELLS AS NOT CREATING PROPERTY RIGHT).
256 App Div 80,9 NYS2d 299-301 (1939).

Descriptors: *New York, *Supervisory control (Power), *Administrative dicisions, *Well permits, Wells, Water supply, Potable water, Administrative agencies, Administration, Legal aspects, Judicial decisions, Legislation, Water demand, Subsurface waters, Well regulation, Water permits, Regulation, Decision making, Institutional constraints, Well spacing.
Identifiers: *Constitutional law.

Petitioner public water company was authorized by defendant Water Power and Control Commission 'to sink as many wells as it may find to be necessary in order to obtain sufficient water to meet the needs of its customers.' Subsequently, without notice, defendant rescinded the authorization. Petitioner sought annulment of the recission order, contending that such order destroyed property rights created by the authorization. The appellate court held that, in allowing petitioner to determine the future necessity for additional wells, the Commission had exceeded its statutory power. This was so even though the authorization had been coupled with the limitation that the Commission must approve all well locations. The authorization, therefore, being in excess of the Commission's power to grant, gave petitioner no right which partook of the aspect of property. Accordingly, when the

uthorization was rescinded, there was no property ght to take away. The recission, not being viola- ve of the due process clause of the Federal Con- itution, was affirmed. (Marsee-Florida)
V70-08581

3E. Conservation in Industry

NDUSTRIAL WATER RECIRCULATION IN ORTHEASTERN ILLINOIS,
linois State Water Survey, Naperville.
obert T. Sasman.
ournal American Water Works Association, Vol 2, No 5, p 269-273, May 1970. 5 p, 4 fig, 2 tab.

escriptors: *Water reuse, *Industrial water, Reclaimed water, *Illinois, Surveys, Water costs, Vater demand, Water supply.
dentifiers: Chicago (Ill).

number of industries, commercial companies, nd service organizations are participating in pro- rams of water recirculation in northeastern Il- nois. Chemical and metal processing industries re doing the most recirculating and food proces- ors are doing very little. Sixteen systems reduced otal pumpage an average of approximately 47 per- ent. Primary reasons presented for recirculating ater included a concern for the availability of the ater, the cost of water, and recent regulations re- arding water quality standards for surface waters eceiving waste water effluent. (Knapp-USGS)
V70-08228

FFECT OF MUNICIPAL WATER SERVICE OLICIES ON ECONOMIC GROWTH IN SUB- RBAN AREAS,
eorgia Inst. of Tech., Atlanta. Engineering Ex- eriment Station.
or primary bibliographic entry see Field 06B.
V70-08420

3F. Conservation in Agriculture

FFECT OF ANTECEDENT SOIL WATER ON RESEASON RAINFALL STORAGE IN A LOWLY PERMEABLE IRRIGATED SOIL,
gricultural Research Service, Bushland, Tex. outhwestern Great Plains Research Center.
or primary bibliographic entry see Field 02G.
V70-08184

LIMATIC ESTIMATES OF AVERAGE AND ROBABLE IRRIGATION REQUIREMENTS ND OF SEASONAL DRAINAGE IN CANADA,
epartment of Agriculture, Ottawa (Ontario). lant Research Inst.
. Baier, and George W. Robertson.
ournal of Hydrology, Vol 10, No 1, p 20-37, Jan 970. 18 p, 7 fig, 7 tab, 21 ref.

escriptors: *Water demand, *Water require- ents, *Irrigation water, *Hydrologic budget, ater balance, Climatology, Evapotranspiration, recipitation (Atmospheric), Rainfall, Water allo- ation (Policy), Water management (Applied), ater distribution (Applied).
dentifiers: *Canada.

he use of published information to calculate verage and probable irrigation requirements by eans of a meteorological budgeting technique rom 30-year daily climatic records is presented. his information, available for 59 stations across anada, is useful for planning irrigation systems nd interpretations of climate in terms of agricul- ural water needs and surplus. A seasonal drainage stimator model requiring as input only monthly alues of precipitation and potential evapotrans- iration was developed from the data for 42 sta- ions and verified on the data for another 17 sta- ions. An irrigation water balance is presented for 1 selected stations across Canada. (Knapp-USGS)
W70-08216

INFLUENCE OF IRRIGATION INTERVAL AND PLANT DENSITY OF ALFALFA SEED PRODUCTION,
American Univ., Beirut (Lebanon). Faculty of Agricultural Sciences.
S. Abu-Shakra, M. Akhtar, and D. W. Bray.
Agronomy Journal, Vol 61, No 4, p 569-571, July-August 1969. 1 tab, 6 ref.

Descriptors: *Irrigation effects, *Alfalfa, *Seeds, *Crop production, *Crop response, Irrigation, Irrigation practices, Environmental effects, Density, Spatial distribution, Semiarid climates.
Identifiers: *Irrigation interval, *Plant density, *Hard seeds, *Lebanon, Pods, Yield components.

Alfalfa was grown in 1966 and 1967 on the Beqa'a Plain of Lebanon in order to study the influence of certain variables on seed production. Plants were irrigated in intervals varying from 1 to 4 weeks and within-row spacings were 25, 50, or 75 cm. The optimum irrigation interval appeared to be once every two weeks for a seasonal water total of 25.7 cm. Such an irrigation frequency produced the highest seed yield and generally increased 1,000-seed weight, number of seeds per pod, and number of pods per raceme. The greatest number of hard seeds came from plants irrigated at 3 or 4-week intervals. The 50-cm plant spacing produced alfalfa with the highest yield per plot. 'African,' 'Chilean,' and 'Hairy Peruvian' varieties of alfalfa were used in the experiment. 'Hairy Peruvian' was the shortest of the three varieties, but produced more seeds per pod and more pods per raceme. (Carr-Arizona)
W70-08341

MOISTURE AND TEMPERATURE EFFECTS ON EMERGENCE AND INITIAL GROWTH OF TWO RANGE GRASSES,
Agricultural Research Service. Crops Research Div.; and New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W70-08342

IRRIGATED WHEAT ON A CALCAREOUS SOIL AS AFFECTED BY APPLICATION OF NITROGEN, PHOSPHORUS, POTASSIUM, AND ZINC: I. YIELD, COMPOSITION, AND NUMBER OF HEADS,
American Univ., Beirut (Lebanon). Faculty of Agricultural Sciences.
H. D. Fuehring.
Agronomy Journal, Vol 61, No 4, p 591-594, July-August 1969. 4 tab, 8 ref.

Descriptors: *Wheat, *Irrigated land, *Calcareous soils, *Fertilizers, *Crop response, Nutrients, Nutrient requirements, Essential nutrients, Deficient elements, Arid lands, Semiarid climates, Irrigation, Supplemental irrigation, Crop production, Cereal crops, Grains (Crops), Nitrogen, Phosphorus, Potassium, Calcium carbonate, Rates of application.
Identifiers: *Lebanon, *Zinc, First order effects, Heads.

A Mexican semi-dwarf wheat, 'Pitic 62,' was grown under irrigation on the calcareous soil of the Beqa'a Plain in Lebanon. Since the soils of this arid and semiarid region lacked sufficient N and P for irrigated crops, experiments were conducted with applications of N, P, K, and Zn. N applications increased grain yield up to 9 metric tons/ha, but at current prices the most economic application rate was 300 kg/ha for a yield of 6 to 8 metric tons/ha. P and Zn tended to reduce grain yield when they were applied. This was apparently due to overstimulation of tillering, which at the normal seeding rate resulted in an excessive number of heads per unit area. Such an increase in tillering may be important if expensive hybrid wheat seeds make it desirable to use low seeding rates. Fertilization with each variable increased its own concentration in the grain. While significant negative first order effects were shown by N on P concentration and by K on Cu concentration, significant positive first order effects were shown by N on Ca concentration and by P on K concentration. Two- and three-way interactions considerably modified some of these first order effects. (Carr-Arizona)
W70-08343

SUMMER FALLOW FOR DRYLAND WINTER WHEAT IN THE SEMIARID GREAT PLAINS,
Agricultural Research Service. Northern Plains Branch; and Nebraska Univ., North Platte. Agricultural Experiment Station.
D. E. Smika.
Agronomy Journal, Vol 62, No 1, p 15-17, January-February 1970. 3 tab, 8 ref.

Descriptors: *Wheat, *Dry farming, *Fallowing, *Crop response, *Great Plains, Semiarid climates, Nebraska, Grains (Crops), Cereal crops, Rotation, Precipitation (Atmospheric), Rainfall, Soil moisture, Soil water, Water management (Applied), Water utilization, Stubble mulching, Crop production, Limiting factors, Fertilizers, Nitrogen.
Identifiers: *Winter wheat, *Water-use efficiency, Crop failure, Nitrogen content.

Continuously cropped wheat was compared with summer-fallowed wheat under semiarid conditions and the fallowed wheat was found to have three times the average yield of the continuous wheat. Not only were there no crop failures recorded for the fallow-wheat during the 27-year study, but fallow-wheat also demonstrated up to 80% greater water-use efficiency than continuous wheat at 43 cm annual precipitation or below. In comparison, continuous wheat failed more than 30% of the time and attained equal water-use efficiency at 58 cm or above only with application of N fertilizer. Continuous wheat required N fertilizer in order to obtain maximum yield, water-use efficiency, and N content. Fallow-wheat, however, contained as much N without fertilization as continuous wheat with fertilization and fertilized continuous wheat used water only 71% as efficiently as unfertilized fallow-wheat. It appears that the summer fallow system is superior to continuous wheat production under semiarid conditions. (Carr - Arizona)
W70-08350

EVAPORATION AND CONDENSATION ON BARE SOIL UNDER IRRIGATION IN THE EAST CENTRAL GREAT PLAINS,
Nebraska Univ., Lincoln. Dept. of Horticulture and Forestry.
For primary bibliographic entry see Field 02D.
W70-08352

DRAINAGE AND SALINITY,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. C. Van Schaik, T. G. Sommerfeldt, and E. Rapp.
Canada Agriculture, Vol 15, No 2, Spring 1970, p. 9-11. 6 fig.

Descriptors: *Irrigation effects, Water tables, Saturated soils, *Salinity, *Tile drains, Canal linings, *Drainage, Irrigation canals, Drainage systems.
Identifiers: Alberta.

Although irrigation projects in the semiarid regions of Western Canada have been beneficial to land reclamation and increased crop production, improper drainage and high soil salt contents have led to waterlogging and salt accumulation. In order to combat these problems the Canadian Department of Agriculture has been experimenting with closely spaced tile drains for subsurface salt drainage and the emplacement of plastic or concrete liners on the bottoms of irrigation canals to water seepage into areas adjacent to the canals. (Holmes-Rutgers)
W70-08359

ULTIMATE SLUDGE DISPOSAL AND SOIL IMPROVEMENT,
Forest Service (USDA), Washington, D.C.
For primary bibliographic entry see Field 05E
W70-08405

PROMOTING AGRICULTURAL DEVELOPMENT,
International Bank for Reconstruction and Development, Washington, D.C.
For primary bibliographic entry see Field 06B.
W70-08427

SOIL WATER USE FROM AN APPLE ORCHARD UNDER VARIOUS SOIL MANAGEMENT SYSTEMS,
Department of Agriculture, Ferntree Gully, (Victoria). Scores by Horticultural Research Station.
J. D. F. Black, and P. D. Mitchell.
Australian Journal of Experimental Agriculture and Animal Husbandry, April 1970, Volume 10, number 43, p. 209-213, 16 references, 2 fig, 4 tables.

Descriptors: *Water loss, Soil moisture, Wilting point, Nuclear meters, Microclimatology, Crop responses, Soil-water-plant relationships.
Identifiers: *Southern Victoria, Paraffin-cadmium technique.

Four soil management systems for growing mature apple trees were tested to determine the comparative amount of water lost during spring and summer. There were no appreciable differences found for total water losses between the four management practices: pasture, pasture with herbicide treatment, trashy cultivation (i.e. spring cultivation followed by summer and autumn weed growth), and clean cultivation (i.e. weeded). However, the apple trees under trashy cultivation lost slightly more water than the others during summer, while the trees grown on pasture lands without herbicide treatment lost more water during spring. (Holmes-Rutgers)
W70-08428

ECONOMIC GUIDELINES FOR LAND AND WATER RESOURCE USE IN AGRICULTURE,
Alberta Univ., Edmonton. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06D.
W70-08432

THE RAFT RIVER BASIN, IDAHO-UTAH, AS OF 1966: A REAPPRAISAL OF THE WATER RESOURCES AND EFFECTS OF GROUNDWATER DEVELOPMENT,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 04B.
W70-08466

THE ARIZONA WATER CONTROVERSY: AN ECONOMIST'S VIEW,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W70-08532

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
For primary bibliographic entry see Field 05B.
W70-08168

SALVI V JOHN A MANNING PAPER CO (NEGLIGENT MAINTENANCE OF A DIKE).

168 Misc 661, 7 NYS2d 36-42 (Sup Ct 1938)

Descriptors: *New York, *Dikes, *Riparian rights, Adjudication procedure, Boundaries (Property), Contracts, Judicial decisions, Legal aspects, Natural flow doctrine, Relative rights, Riparian land, Riparian waters, Remedies, Damages, Dam failure, Floods, Maintenance, Usufructuary right, Flooding, Flood damage.
Identifiers: *Negligence, *Affirmative covenants, *Dam maintenance.

Defendants owned a dike which had fallen into disrepair through neglect. Consequently the creek which the dike had impounded flooded plaintiff's land. Plaintiff contended that defendants were bound by an affirmative covenant in a deed which their predecessor in title had negotiated to keep the dike in repair. Plaintiff sought the enforcement of this covenant and damages for defendants' negligent maintenance of the dike. The court held that an affirmative covenant is personal, not real, and as such it will not run with the land. Consequently, plaintiff could not seek enforcement of such covenant. The court held further, however, that notwithstanding the existence of an affirmative covenant to repair, responsibility for damages caused by negligent maintenance of a dam is generally imposed on the owner of the structure. Plaintiff's complaint sufficiently alleged such negligence on the part of defendants. Defendants' motion to dismiss the complaint as a whole was denied. (Clarke-Florida)
W70-08180

FLOOD PLAIN INFORMATION, SUSQUEHANNA AND CHENANGO RIVERS (TRIPLE CITIES AREA), BROOME COUNTY, NEW YORK.
Corps of Engineers, Baltimore, Md.

US Army Corps of Engineers Flood Plain Report, December 1969. 57 p, 4 fig, 23 plate, 17 tab.

Descriptors: *Floods, *Flood damage, *New York, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Broome County (N Y), Susquehanna River (N Y), Chenango River (N Y), Standard project flood, Intermediate regional flood.

Flooding of the Susquehanna and Chenango Rivers, Broome County, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-08196

CRITICAL EVALUATION OF CERTAIN METHODS OF UNSTEADY GROUNDWATER HYDRAULICS,
Wisconsin Univ., Milwaukee; and Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-08230

FLOOD PLAIN INFORMATION, RIDLEY CREEK, DELAWARE COUNTY, PENNSYLVANIA.
Corps of Engineers, Philadelphia, Pa.

US Army Corps of Engineers Flood Plain Report, April 1970. 53 p, 10 fig, 15 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Pennsylvania, Flood plains, Historic flood, Flood forecasting, Regional flood, Design flood.
Identifiers: *Ridley Creek, *Delaware County (Pa), Standard project flood, Intermediate regional flood

Flooding of Ridley Creek in Delaware County, Pennsylvania, from its confluence with the Delaware River at Chester, Pennsylvania, upstream to the Delaware-Chester County Line is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights, and other technical data. (Woodard-USGS)
W70-08235

FLOOD PLAIN INFORMATION, CROOKED CREEK AND TRIBUTARIES, HARRISON, ARKANSAS.
Corps of Engineers, Little Rock, Ark.

US Army Corps of Engineers Flood Plain Report, February 1970. 36 p, 18 fig, 16 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Arkansas, Flood plains, Historic flood, Flood forecasting, Regional flood, Design flood.
Identifiers: *Crooked Creek, *Harrison (Ark).

Flooding in and near Harrison, Arkansas along Crooked Creek is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights, and other technical data. (Woodard-USGS)
W70-08238

THIRD BUCKINGHAM COMMUNITY, INC V ANDERSON (COLLECTION AND DISCHARGE OF SURFACE WATER ONTO ADJOINING LAND).

178 Va 478, 17 SE2d 433-437 (1941).

Descriptors: *Virginia, *Drainage systems, *Surface runoff, *Riddance (Legal aspects), Drainage water, Surface drainage, Repulsion (Legal aspects), Surface waters, Floods, Artificial watercourses, Storm drains, Tiles, Subsurface drainage, Land tenure, Real property, Damages, Flood damage, Judicial decisions, Legal aspects, Relative rights.

Plaintiff and defendant were adjoining landowners. Plaintiff devoted his land to raising various marketable crops. Defendant erected apartment houses and a drainage system on his land. The drainage system collected all the drainage water on defendant's land and discharged it with great force and volume through a single large pipe onto plaintiff's land causing serious flooding and the accumulation of debris. Plaintiff sued for damages. In holding for plaintiff, the court acknowledged that the common law rule enabling a landowner to protect himself from surface waters prevailed in Virginia. However, the privilege could not be exercised wantonly or unnecessarily, and a landowner could not use his property so as to injure the rights of another. Thus, a landowner could not collect surface water into an artificial channel and cast it in greatly increased or unnatural quantities upon his neighbor's land even if the quantity was no greater than what would have been received in a more dispersed manner. (Hubener-Florida)
W70-08239

FLOOD PLAIN INFORMATION, PORTNEUF RIVER AND TRIBUTARIES NEAR POCATELLO, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.

US Army Corps of Engineers Flood Plain Report, March 1970. 48 p, 13 fig, 22 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Idaho, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.

dentifiers: Pocatello (Idaho), Standard project lood, Intermediate regional flood.

Flooding of the Portneuf River, Pocatello, Idaho nd vicinity is described in a report of flood plain roblems based on records of rainfall, runoff, and istorical and present flood heights. Maps, photo-raphs, profiles, and cross sections indicate the ex-ent of flooding that has occurred and which may e expected to occur in the future. The information s for use in study and planning ways to minimize ulnerability to flood damages by control of flood lain use by zoning and subdivision regulations, the onstruction of flood protection works, or by com-inations of these approaches. (Knapp-USGS)
W70-08245

FLOOD PLAIN INFORMATION, TRANQUITAS, SANTA GERTRUDIS AND ESCONDIDO CREEKS, KINGSVILLE, TEXAS.
Corps of Engineers, Galveston, Tex.

US Army Corps of Engineers Flood Plain Report, April 1970. 36 p, 5 fig, 17 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: *Kingsville (Tex), Standard project flood, Intermediate regional flood.

Flooding of the Kingsville area, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-08246

FLOOD PLAIN INFORMATION, FLOYDS FORK, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

U S Army Corps of Engineers Flood Plain Report, May 1969. 30 p, 5 fig, 11 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Kentucky, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Jefferson County (Ky), Louisville (Ky), Standard project flood, Intermediate regional flood.

Flooding of Floyds Fork, Jefferson County, Kentucky is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-08260

FUNDAMENTAL PRINCIPLES OF THE METHOD FOR COMPUTING MAXIMUM RUNOFF,
For primary bibliographic entry see Field 02E.
W70-08271

FLOOD PLAIN INFORMATION, POND CREEK, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.

US Army Corps of Engineers Flood Plain Report, November 1968. 35 p, 5 fig, 10 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Kentucky, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Jefferson County (Ky), Louisville (Ky), Standard project flood, Intermediate regional flood.

Flooding of Pond Creek, Jefferson County, Kentucky is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-08281

O'BARR V DUNCAN (RIGHT TO MAINTAIN DAM).

2 SE2d 82-83 (Ga 1939).

Descriptors: *Georgia, *Dams, *Obstruction to flow, *Easements, Streams, Surface waters, Running waters, Shallow waters, Earth dams, Barriers, Damsites, Land use, Real property, Farm management, Legal aspects, Judicial decisions, Riparian rights, Maintenance, Water levels, Relative rights.
Identifiers: *Fords.

Plaintiff upstream property owners sought an injunction against defendant downstream riparian owner to prohibit the maintenance of a dam on the stream which ran through their properties. Plaintiffs contended that they were prohibited from full use of their peoperty by the fact that defendant's dam caused the stream water to back up so as to interfere with a ford used by the plaintiffs. Defendant admitted maintaining the dam but claimed that his predecessors in title had also done so and that his dam was no different than the earlier one. Defendant claimed that an easement for the maintainance of the dam was reserved by his grantors and that non-use of such easement did not constitute abandonment as argued by plaintiff. In affirming the trial court's decision for the defendant, the Supreme Court of Georgia ruled that non-use did not mean abandonment of an easement and that the reservation of an easement was equivalent to an express grant of one. The court held that the evidence established that defendant did in fact have such an easement for maintaining a dam. (Barker-Florida)
W70-08289

FRADY V CAROLINA MOUNTAIN POWER CORP (LIABILITY FOR FLOOD DAMAGE DUE TO OPENING FLOODGATES).

196 SE 817-818 (NC 1938).

Descriptors: *North Carolina, *Dams, *Overflow, *Floodgates, Upstream, Streams, Damages, Lakes, Water injury, Flooding, Floodwater, Streamflow, Judicial decisions, Legal aspects, Rain, Rainfall, Rain water, Water storage, Standards, Regulation, Precipitation excess, Flood damage.

Defendant power company operated a dam about eight miles upstream from plaintiff's land. Rain water gradually accumulated in a lake above the dam until such water was overflowing a portion of the dam. In order to release the impounded water from the lake, defendant opened the flood gates of the dam, thereby releasing great volumes of water from the lake and into a stream below, which was already in a swollen condition. As a result of this increased amount of water, the stream overflowed onto plaintiff's land, causing damages to the land and the crops thereon. Plaintiff instituted proceedings to recover damages due to defendant's negligent operation of the dam. In a per curiam opinion, the appellate court affirmed the lower court's judgement for plaintiff. (Finman-Florida)
W70-08299

HASKELL V STATE (IMPROPER CONTROL OF CANAL FLOODGATE).
283 NY 612, 28 NE2d 27-28 (1940).

Descriptors: *New York, *Flood damage, *Floodgates, *New York State Barge Canal, Canal design, Canal construction, Design flow, Gates, Transportation, Engineering structures, Overflow, Control structures, Real estate, Flood control, Damages, Judicial decisions, Legal aspects, State government.

Plaintiff, as executrix of claimant's estate, brought action to recover for damages to claimant's lands, seawall, and shrubbery which was caused by flood waters from the lake on which the lands bordered. The lake constituted part of a barge canal system. Plaintiff contended that a floodgate and guard gate constructed and operated by the state to control an outlet from the lake were of inadequate size to exercise flood control. Furthermore, plaintiff alleged that the outlet gates had been closed when they should have been opened to permit the flow of water. The court, in a per curiam decision, affirmed the trial court's judgement for plaintiff. (Hubener-Florida)
W70-08331

UNION DRAINAGE DIST NO 5 V HAMILTON (ASSESSMENT AGAINST PROPERTY HOLDER FOR DRAINAGE IMPROVEMENT).
390 Ill 487, 61 NE2d 343-348 (1945).

Descriptors: *Illinois, *Drainage systems, *Tile drains, *Repairing, Drainage districts, Drainage, Surface drainage, Drainage programs, Surface waters, Controlled drainage, Culverts, Surface runoff, Diversion, Natural flow doctrine, Ditches, Drains, Diversion structures, Legislation, Legal aspects, Judicial decisions, Federal government, Roads, Outlets, Administrative agencies, Adjudication procedure.

Plaintiff drainage district sought confirmation of an assessment against defendant for repairs of a tile drainage system. The network had been built by the W.P.A., and plaintiff contended that the repairs were necessary to bring the system up to the level of efficiency contemplated by the original plans. Defendant argued that the network of drainage ditches was functioning properly and that the plaintiffs were attempting to discredit the reputation of the drainage district commission which had supervised the original construction. Defendant had been a member of that commission. Defendant further argued: that the proposed improvements would constitute an unlawful diversion of surface waters over his land, that the improvements would become clogged with quicksand in the same manner as the old, and that plaintiff had failed to show that sufficient outlets for the drainage were included in the plans. In affirming the trial court's judgment for plaintiff, the Supreme Court of Illinois held that defendant's objections were properly submitted to the jury and that the verdict was within the range of testimony offered at trial. (Barker-Florida)
W70-08339

DRAINAGE AND SALINITY,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 03F.
W70-08359

FRAZIER V VILLAGE OF WESTERVILLE (LIABILITY FOR FLOOD DAMAGES CAUSED BY DAM).

36 NE2d 812-819 (Ohio Ct App 1941).

Descriptors: *Ohio, *Damages, *Cities, *Obstruction to flow, Dams, Ditches, Drains, Pipes, Tile drainage, Drainage engineering, Judicial decisions, Legal aspects, Overflow, Flood damage, Rain water, Riparian rights, Streams, Water works, Banks, Dikes, Retaining walls, Relative rights.

Plaintiffs and defendant village owned land bordering a stream. Defendant constructed a permanent concrete dam and dikes across the stream for the improvement of its waterworks which subsequently caused the stream to overflow plaintiffs' land. Plaintiffs brought suit for damages. Defendant contended that the flood was due to an act of God as a result of excess rainfall, and consequently the flooding was entirely beyond its control. Also defendant contended that plaintiffs were not the owners of the property at the time the improvements were made, thus the cause of action did not inure to them but rather inured to plaintiffs' grantors. The court found no evidence to support the defence of an act of God in the high water and flood conditions were not so unusual or unexpected as to be unforseen by defendant when constructing the improvements. The court found that construction of the improvements was no completed until after plaintiffs had acquired their land, so plaintiffs did have a cause of action for damages. In holding for plaintiffs, the court found the measure of damages to be the difference between the value of the property before the injury and the market value of it after the injury. (Barnett-Florida)
W70-08382

STOER V OCALA MFG ICE AND PACKING CO (RIGHTS AND OBLIGATIONS OF LOWER RIPARIAN OWNERS).
24 So 2d 579-581 (Fla 1946).

Descriptors: *Florida, *Alteration of flow, *Natural flow doctrine, *Surface waters, Obstruction to flow, Surface drainage, Natural flow, Riparian land, Relative rights, Agriculture, Cultivated lands, Carrying capacity, Drainage practices, Irrigation canals, Irrigation ditches, Dams, Dikes, Bridges, Drainage districts, Watercourses (Legal), Natural streams, Riparian rights, Diversion structures, Legal aspects, Judicial decisions.

Plaintiff, a lower riparian landowner, sought to enjoin defendant corporation from alternately storing and releasing surface water through the use of wells, dams, culverts, gate valves, ditches, and dikes. Plaintiff contended that defendant's actions altered the natural flow of the river and caused inundation and damage to his property. Defendant contended that the damage was a result of the plaintiff's having built fences, low bridges, and foot logs over the river bed causing hyacinths and drift to collect and retard the flow and carrying capacity of the river. The court acknowledged as settled law that an upper proprietor may drain surface water from his lands into a natural watercourse, but is not permitted to collect and impound quantities of water and discharge it into a natural watercourse in such a way as to overtax it and inundate lands of a lower proprietor. However, plaintiff was in a cooperative drainage area and had a duty to keep his waterways open. Plaintiff had been negligent, and therefore was not entitled to relief. (Price-Florida)
W70-08426

MILLER V ERVIN (DAMAGES RESULTING FROM DRAINAGE DITCH CONSTRUCTION).
6 So 2d 910-914 (Miss 1942).

Descriptors: *Mississippi, *Ditches, *Railroads, *Right of way, Civil engineering, Transportation, Drainage, Excavation, Water conveyance, Surface waters, Damages, Overflow, Flooding, Construction, Grading, Landfills, Construction costs, Costs, Alternative costs, Comparative costs, Total costs, Absorption, Judicial decisions, Legal aspects.

Plaintiff land owner brought suit against defendants, receivers of a railroad, for damages to her land which resulted from overflow from a pond. The damages allegedly occurred when defendants dug a ditch on the railroad right-of-way. Plaintiff claimed that the ditch increased the velocity of accumulation in the pond which resulted in its overflowing and that prior to the digging of the ditch, a great deal of the surface water had been absorbed by the roadbed. Defendants argued that the ditch excavation was a reasonable use of their right-of-way and that no other method of improving the railroad's operation could have been employed as efficiently or cheaply as getting the needed fill from a ditch. The Supreme Court of Mississippi ruled that the railroad would only be held liable for damages caused by the resulting overflow if it could be shown that another method of securing fill for its roadbed would have been equally safe, convenient, and inexpensive as the one used. The trial court's judgment for the defendants was affirmed. (Barker-Florida)
W70-08442

DADE COUNTY V SOUTH DADE FARMS, INC (INJUNCTION AGAINST REMOVAL OF DAM).
182 So 858-862 (Fla 1938).

Descriptors: *Florida, *Dams, *Drainage, *Natural flow, Natural flow doctrine, Alteration of flow, Diversion, Surface waters, Obstruction to flow, Right of way, Local governments, Legal aspects, Surface drainage, Drainage systems, Diversion structures, Ditches, Culverts, Laterals, Dikes, Judicial decisions, Relative rights, Drainage density.

Plaintiff agricultural corporation sought an injunction against defendant county to prohibit removal of a dam built by plaintiff. Defendant had constructed a road on its right of way through plaintiff's land and had provided culverts beneath the road for drainage. Plaintiff claimed that the drainage system had gathered surface waters at an increased rate and had diverted the water onto his land causing unnatural flooding. To alleviate this flooding plaintiff dammed the culvert and opened a ditch to provide for less harmful drainage. Defendant argued that building the dam was unauthorized and had caused damage, expense, and inconvenience to them. Defendant further claimed that plaintiff infringed on its sole right to control drainage on the site. In affirming the trial court's granting of plaintiff's injunction, the Supreme Court of Florida ruled that no person has the right to gather surface waters, divert them from their natural flow and cast them on the land of another. The court also found that as a result of plaintiff's dam, the land enjoyed better drainage than before the dam. (Barker-Florida)
W70-08443

OPTIMIZATION OF THE STREAM FLOW REGULATION BY THE HYDROELECTRIC STATIONS RESERVOIRS WITH THE HELP OF MATHEMATICAL MODELS,
Akademiya Nauk SSSR.
L. S. Belyaev, and Y. P. Syrov.
13th Congress International Association Hydraulic Research, Proceedings, Vol 1, p 17-23, Aug-Sept 1969. 7 p, 12 ref.

Descriptors: *Reservoir operation, *Mathematical models, Reservoir storage, Scheduling, Streamflow, Optimization, Calculations, Foreign research, Hydroelectric plants, Hydroelectric power, Digital computers, Analytical techniques, Algorithm, Water resources, Electric power demand, Planning, *River regulation.
Identifiers: Hydroelectric resources, USSR, *Analytical method, *Hydrologic models, *Streamflow regulation.

Mathematical models and optimization methods for yearly and multiple-year flow regulation of hydroelectric station reservoirs of power and water resource systems are given. Different qualitites of initial information lead to corresponding mathematical models and methods. Because strict probabilistic methods are extremely difficult, approximate methods for annual operation of system with numerous hydropower stations are proposed. The methods are based on probabilistic and deterministic calculations of flow regulation. Deterministic calculations can be used with the gradient method and the Pontryagin maximum principal. The dispatch scheduling of multiple-year storage needs special game theory and statistic decisions criteria because of uncertain initial information. A choice solution to the most reasonable operation of power systems with several stations on multiple-year storage is presented. (USBR)
W70-08454

HOLLEY V LOUISIANA RY AND NAVIGATION CO (FLOOD DAMAGES FROM INADEQUATE DRAINAGE CULVERT).

165 So 703-708 (La 1936).

Descriptors: *Louisiana, *Culverts, *Drainage, *Flooding, Damages, Overflow, Floods, Flood damage, Storms, Conduits, Conveyance structures, Engineering structures, Drains, Surface drainage, Surface waters, Railroads, Rain, Cloudbursts, Rainfall intensity, Runoff, Weather patterns, Precipitation intensity, Judicial decisions, Legal aspects.

Plaintiff land owners sought to recover damages from defendant railroad which resulted from flooding caused by the inability of defendant's culvert to carry off accumulated water. Defendant had constructed the culvert as a replacement for a trestle. Plaintiffs alleged that while the trestle had existed, their land was not subject to overflow from rainfall and that the culvert was inadequate to provide normal flow. Defendant argued that the rainfall which caused the flooding was phenomenal in amount and that the culvert was of equal capacity as the channel below it so that the flooding would have occurred regardless of the culvert. Expert and lay testimony presented by both parties was greatly in conflict. In reversing the trial court's verdict for the plaintiffs, the Supreme Court of Louisiana ruled that since the culvert was capable of carrying all the water which could have been drained by the lower channel, the damage caused to plaintiffs' crops and land was the result of phenomenal rain, not the replacement of the trestle by defendants. (Barker-Florida)
W70-08471

FLOOD PLAIN INFORMATION, QUINNIPIAC RIVER, SOUTHINGTON, CONNECTICUT.
Corps of Engineers, Waltham, Mass.

US Army Corps of Engineers Flood Plain Report, January 1970. 39 p, 20 photo, 9 plate.

Descriptors: *Floods, *Flood damage, *Connecticut, Flood plains, Historic flood, Flood forecasting, Regional flood, Design flood.
Identifiers: *Quinnipiac River, *Southington (Conn).

Flooding of the Quinnipiac River in Southington, Connecticut is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W70-08482

MCCUTCHEN V VILLAGE OF PEEKSKILL (RIGHT TO DISCHARGE SURFACE WATERS INTO NATURAL WATERCOURSE.

167 Misc 460, 3 NYS2d 277-280 (Sup Ct 1938).

Descriptors: *New York, *Surface drainage, *Surface run-off, *Riparian rights, Land drainage, Natural streams, Ditches, Aqueducts, Bridges, Drainage effects, Drainage water, Surface water,

verland flow, Precipitation excess, Obstruction to ow, Relative rights, Sewers, Drainage systems, Ci- es, Overflow, Flooding, Flood damage, Flow aug- entation, Judicial decisions, Legal aspects.

aintiff brought action against defendant village to cover for damages which occurred when a brook, hich ran through the village and adjacent to plain- ff's property, overflowed. Defendant drained its rface waters through sewers into the brook and id constructed, pursuant to an agreement with aintiff's grantors, a highway over the part of the rook abutting plaintiff's property. Neither the ow nor the course of the brook was altered by this onstruction. Defendant later constructed addi- onal drainage sewers, and the state constructed a aduct. Surface water therefrom was discharged nto the brook. During heavy rains, the capacity of ne brook was insufficient to accomodate the sur- ace waters drained therein. The court held that the illage was under no duty to prevent the overflow f the brook. However, although a riparian lan- owner has a right to drain surface water into a tream which is the natural outlet for such water, e is liable for damages resulting from his overtax- ng of such stream's capacity. The burden was on laintiff to establish that the flooding was caused by efendant's construction of artificial channels. The vidence did not show the construction of the ewers and highway to be the cause of the overflow. Consequently, judgement for defendant was ranted. (Price-Florida)
W70-08502

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER AND OLEAN CREEK, OLEAN, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.

US Army Corps of Engineers Flood Plain Report, August 1969. 56 p, 12 fig, 13 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *New York, Flood plains, Historic flood, Flood forecasting, Regional flood, Design flood.
Identifiers: *Olean Creek, *Allegheny River (Olean, N.Y.).

The flood situation along the Allegheny River and Olean Creek within the city limits of Olean, New York, and small portion of the Allegheny River in the town of Olean, upstream from the city of Olean is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W70-08505

FLOOD PLAIN INFORMATION OF ALKALI CREEK - VOLUME II, BILLINGS METROPOLITAN REGION, MONTANA.
Corps of Engineers, Omaha, Nebr.

US Army Corps of Engineers Flood Plain Report, October 1969. 18 p, 2 plate, 2 tab.

Descriptors: *Floods, *Flood damage, *Montana, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Billings (Mont), Standard project flood, Intermediate regional flood.

Flooding of Alkali Creek, Billings, Montana is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-08506

FLOOD PLAIN INFORMATION, MARTINS CREEK, NORTHAMPTON COUNTY, PENNSYLVANIA.
Corps of Engineers, Philadelphis, Pa.

US Army Corps of Engineers Flood Plain Report, March 1970. 43 p, 13 fig, 12 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Pennsylvania, Flood plains, Historic flood, Flood forecasting, Regional flood, Design flood.
Identifiers: *Martins Creek, *Northampton County (Penn).

Flooding of Martins Creek area from its confluence with Waltz Creek upstream to the southerly edge of Bear Swamp in Northampton County, Pennsylvania is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W70-08511

FLOOD PLAIN INFORMATION, MANITOWOC COUNTY, WISCONSIN.
Corps of Engineers, Chicago, Ill.

US Army Corps of Engineers Flood Plain Report, May 1970. 67 p, 19 fig, 19 plate, 18 tab.

Descriptors: *Floods, *Flood damage, *Wisconsin, Flood plains, Historic flood, Flood forecasting, Regional flood, Design flood.
Identifiers: *Manitowoc County (Wis).

The flood situation along the five streams in Manitowoc County, Wisconsin - East Twin River, West Twin River, Manitowoc River, Little Manitowoc River, and Silver Creek - is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and test material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall, runoff, historical flood heights and other technical data. (Woodard-USGS)
W70-08512

A TEST OF FLUSHING PROCEDURES TO CONTROL SALT-WATER INTRUSION AT THE W. P. FRANKLIN DAM NEAR FT. MYERS, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 05G.
W70-08516

THE MAGNITUDE AND EXTENT OF SALT-WATER CONTAMINATION IN THE CALOOSAHATCHEE RIVER BETWEEN LA BELLE AND OLGA, FLORIDA,
Geological Survey, Tallahassee, Fla.
For primary bibliographic entry see Field 05B.
W70-08517

SCHEME FOR THE QATTARA DEPRESSION,
Technische Hochschule, Darmstadt (West Germany).
For primary bibliographic entry see Field 08A.
W70-08523

HYDRO POTENTIAL OF THE TEXAS WATER PLAN,
Texas Tech. Univ., Lubbock.
For primary bibliographic entry see Field 08A.
W70-08524

QUANTITATIVE MORPHOLOGY OF THE DRAINAGE BASIN IN SEMI-ARID ENVIRONMENT,
Central Arid Zone Research Inst., Jodhpur (India).
For primary bibliographic entry see Field 02E.
W70-08526

ROUTING MODIFICATIONS TO SUBURBAN DESIGN HYDROGRAPHS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
Brian M. Reich.
Preprint 1141, Proceedings, American Society Chemical Engineers Natural Water Resources Engineering Meeting, Memphis, Tenn, Jan 26-30, 1970. 26 p, 12 fig, 1 tab, 22 ref. OWRR Project No B-010-PA.

Descriptors: *Flood forecasting, *Urbanization, *Routing, *Flood control, Open channel flow, Computer programs, Flood routing, Hydrographs, Hydrograph analysis, Planning, Mathematical models, Storm runoff.
Identifiers: Storm runoff planning.

Stormwater disposal in heterogeneous watersheds that typify modern suburban developments involves the routing of flood flows which arise on first- and second-order tributaries. Streamflow measurements are absent so that the input to the routing must be synthetic hydrographs. Urban and rural hydrographs generated from drainage basin features and a hypothetical rain are combined and routed through streams and proposed reservoirs so that effective use may be planned for the valley bottoms downstream. The influence of deep, narrow flood channels as opposed to broad park-like swales must be studied through the application of routing calculations based upon hydraulic properties. Four watersheds in the fringe suburbs of Philadelphia, Penn., were studied as examples of the suburban setting common to the Northeast. Neither channel routing nor reservoir routing obliterate hydrograph differences. The very small improvement in flood control achieved by combining flat parabolic swales rather than deep rectangular channels with reservoirs may be omitted from considerations on using riparian land for business enterprises. (See also W70-07981) (Knapp-USGS)
W70-08540

WARGO V CONNECTICUT LIGHT AND POWER CO (RELEASE OF IMPOUNDED WATERS AS A RESULT OF NEGLIGENTLY CONSTRUCTED FLASHBOARDS).

127 Conn 629, 18 A2d 924-927 (1941).

Descriptors: *Connecticut, *Hydroelectric plants, *Impounded waters, *Dam failure, Floodgates, Impoundments, Dams, Diversion, Alteration of flow, Obstruction to flow, Riparian rights, Relative rights, Legal aspects, Judicial decisions, Natural flow doctrine, Spillways, Snowmelt, Floods, Floodwater, Damages, Excessive precipitation, Legislation, Rivers, Reasonable use.
Identifiers: *Causation (Legal), *Freshets.

Due to heavy rains and melting snow, there was a freshet in the Housatonic River. Plaintiffs, who were situated a mile below the dam of defendant hydroelectric developer, had their lands damaged and their cottages swept away when flashboards on the dam gave way, thereby releasing the impounded waters. Plaintiffs brought action alleging negligence in the construction and operation of the dam. They contended that defendant was negligent in constructing the flashboards without the permission required by statute, and that such negligence was the proximate cause of their injury. Defendant argued that plaintiff had not proved by the evidence that the damage was not an act of God due to the freshet. The appellate court, in holding for plaintiffs, found the evidence sufficient to support the finding of negligence on the part of the defendant. An upper proprietor upon a stream has no right to gather and impound waters and then sud-

denly release them onto the land of lower proprietors. Each riparian owner is limited to reasonable use of water with due regard to rights of other such owners. It is the common right to have the stream preserved in its natural size, flow and purity without material diversion. (Marsee-Florida)
W70-08550

YATES V METROPOLITAN GOV'T OF NASHVILLE AND DAVIDSON COUNTY (WATER DAMAGE FROM IMPROPER CONSTRUCTION OF FACILITIES).

451 SW2d 437-444 (Tenn Ct App 1969).

Descriptors: *Tennessee, *Easements, *Cities, *Drainage, Diversion, Surface waters, Water works, Pumping, Damages, Ditches, Roads, Paving, Structures, Alteration of flow, Public benefits, Repairing, Engineering structures, Discharge (Water), Public rights, Utilities, Graded, Local governments, Judicial decisions, Legal aspects.

Plaintiff brought action against defendant city for water damage to his property allegedly resulting from the improper construction or maintenance of facilities on an easement adjoining plaintiff's land. Drainage ditches associated with defendant's easement intercepted the natural drainage flow of surface water and diverted it in an unnatural flow upon plaintiff's property. The issues on appeal from a decision for defendant were: (1) was the city liable for damages where it was operating a water system in an easement dedicated to the public, where the surface of the easement constituted a nuisance and damaged a neighboring property owner; and (2) was defendant obligated to remove the diversionary ditch located on the easement. The court held that the city was not liable and that the use of an easement does not entail general maintenance of the land over which it passes unless the holder has made such maintenance necessary by the manner of the use of his easement. The defendant could not be liable where there was no showing that he actually created the nuisance as an incident to the use of his easement. (Barnett-Florida)
W70-08555

S L GARLAND CO V EVERLASTING MEMORIAL WORKS, INC (INJUNCTION AGAINST INTERFERENCE WITH DRAINAGE DITCH).
264 A2d 776-778 (Vt 1970).

Descriptors: *Vermont, *Drainage, *Damages, *Boundary disputes, Boundaries (Property), Legal aspects, Water law, Ditches, Drainage systems, Surface waters, Obstruction to flow, Barriers, Land use, Judicial decisions, Conveyance structures, Flood damage, Remedies, Relative rights.
Identifiers: Injunction (Prohibitory).

Following a lengthy dispute over a common boundary, plaintiff brought action for trespass, alleging that defendant corporation had encroached upon its land by construction of a building and installation of underground tanks. Defendant counterclaimed alleging that plaintiff wrongfully obstructed and destroyed a drainage ditch designed to carry off water from the properties of both parties. Defendant claimed that as a result, great quantities of water were diverted onto defendant's land causing damage to its plant, facilities, and products and impeding access to the plant. The Supreme Court of Vermont ruled that dismissal of plaintiff's suit was proper since the resolution of the boundary dispute was in favor of defendant. In addition, the court held that the equitable relief of injunction against plaintiff's interference with the drainage was appropriate and within the jurisdiction of the trial court. (Barker-Florida)
W70-08557

FOREST CITY COTTON CO V MILLS (ACCUMULATION OF SEDIMENT IN TRIBUTARY OF DAMMED RIVER AS CREATING DRAINAGE OBSTRUCTION).

219 N C 279, 13 SE2d 557-561 (1941).

Descriptors: *North Carolina, *Mill dams, *Deposition (Sediments), *Reasonable use, Bed load, Bottom sediments, Damages, Legal aspects, Judicial decisions, Natural flow doctrine, Riparian land, Riparian rights, Riparian waters, Natural streams, Impounded waters, Impoundments, Tributaries, Sedimentation, Sediment transport, Sedimentation rates, Remedies, Adjudication procedure, Sands, Ponding.

Plaintiff owned land on a tributary of the river on which defendant operated a mill dam. Plaintiff's land was eight miles above the dam. Plaintiff contended the dam had impeded the flow of the river, which had in turn impeded the flow of the tributary, and that sand and debris were thereby caused to accumulate in the tributary. This made it impossible to drain plaintiff's land. The case was tried in the lower court on the theory of permanent damages, allegations of negligence being eliminated. The appellate court affirmed, finding the evidence sufficient to support the verdict for the defendant. The dissenting opinion urged that the lower court had committed reversable error by instructing the jury concerning the reasonable use doctrine. That doctrine properly applies to lower riparian owners, and here plaintiff was an upper riparian owner. The dissent felt that when a lower owner constructs a dam which causes injury to an upper proprietor, the lower owner becomes liable for injury whether he operates his dam reasonably or unreasonably. (Price-Florida)
W70-08559

NATCHER V CITY OF BOWLING GREEN (COMPENSATION FOR INTERFERENCE BY DAM CONSTRUCTION WITH RIPARIAN RIGHTS).
264 Ky 584, 95 SW2d 255-260 (1936).

Descriptors: *Kentucky, *Riparian rights, *Navigation, *Eminent domain, Dams, Beneficial use, Navigable rivers, Bodies of water, Surface waters, Beds, Ownership of beds, Reservoirs, Riparian waters, Dam construction, Damages, Damsites, Cities, Water resources development, Judicial decisions, Gravels, Beds under water, Municipal water, Compensation, Local governments.

Plaintiff landowner sought removal of a dam which had been constructed by defendant city. Plaintiff owned two gravel bars in a river used by the city as its municipal water supply. When the dam was constructed, the water level of the river was raised and plaintiff could no longer gain access to the bars. Plaintiff argued that defendant had no power to destroy his access to the bars but, if so, then the city was required to compensate him for his loss. Defendant claimed the authority to build the dam through its power to improve navigability of the river and that such action required no compensation of riparian owners. The Court of Appeals of Kentucky, reversing the trial judgment for the city, found that mere expression of increased navigability was insufficient to justify interference with riparian rights where the facts showed no such improvement in navigation. The city could justify the dam construction on the grounds of increasing the municipal water supply and could utilize the eminent domain process to achieve that purpose, but riparian owners had to be compensated for loss of their riparian rights. (Barker-Florida)
W70-08565

COOPER V WILSON (DAMAGES FROM STREAMFLOW DIVERSION).
271 Ky 74, 111 SW 2d 436-437 (1937).

Descriptors: *Kentucky, *Obstruction to flow, *Alteration of flow, *Diversion, Damages, Relative rights, Dams, Natural flow doctrine, Streamflow, Streams, Running waters, Surface waters, Valleys, Barriers, Diversion structures, Judicial decisions, Legal aspects, Brush, Overflow, Flooding.

Plaintiff landowner brought action to recover damages caused his property by defendant's diversion of a stream. The stream ran through the property of bothparties. Plaintiff contended that defendant had constructed a brush dam which caused the water from the stream to overflow onto plaintiff's land, thus flooding a certain portion thereof. Defendant argued that he was merely seeking to avoid damages caused by plaintiff's erection of a fence on the stream. The fence accumulated debris carried by the stream, backed up the flow of the stream, and diverted it onto defendant's property. The Court of Appeals of Kentucky, in affirming the trial court's judgment for the defendant, ruled that in an action for damages from diversion of a natural stream, a defendant is relieved of liability when such diversion is performed only to protect against damages caused by a plaintiff who has also diverted the natural flow of the stream. (Barker-Florida)
W70-08566

EVANS V MASSMAN CONST CO (FLOODING RESULTING FROM CONSTRUCTION OF DIKE UPON NAVIGABLE RIVER).
122 SW2d 924-936 (Mo 1938).

Descriptors: *Missouri, *Dikes, *Floods, *Flood damage, Engineering structures, Structures, Barriers, Levees, River training, Overflow, Damages, Federal government, Project planning, River regulation, Rivers, Navigable rivers, Engineering, Backwater, Judicial decisions, Legal aspects.

Defendant construction company, under a government contract and pursuant to a governmental plan, built a dike to improve the navigation of the Missouri River. In an action to recover damages for flooding, plaintiff contended that defendant had negligently constructed the dike which led to a retardation of the river's flow which resulted in the river overflowing its banks so as to inundate plaintiff's land. Plaintiff proceeded under two theories. First, plaintiff contended that defendant was negligent in planning and supervising the construction of the dike. Second, plaintiff contended that defendant was negligent in not building the dike according to the government's specifications. The court held that defendant was not liable for negligent planning and supervision since under the contract the government was responsible for planning and supervising. The court held further that plaintiff failed to establish that defendant's negligence, if any, was the proximate cause of the flooding in that it was not shown that the flooding could not have occurred even though the dike had not been built. The jury verdict for plaintiff was reversed. (Snow-Florida)
W70-08570

FISHER V ARKANSAS POWER AND LIGHT CO (NEGLIGENT RELEASE OF IMPOUNDED WATERS BY DAM OWNER).
150 SW2d 959-962 (Ark 1941).

Descriptors: *Arkansas, *Dams, *Discharge (Water), *Impounded waters, Damages, Floods, Surface water, Reservoirs, Reservoir operation, Operations, Water control, Water supply, Impoundments, Gates, Flood damage, Engineering structures, Judicial decisions, Legal aspects, Water storage, Spillway gates, Gate control, Hydroelectric plants, Hydroelectric power, Land tenure.

Plaintiffs, downstream landowners, sought to recover damages to their properties resulting from defendant power company's operation of dams. Plaintiffs contended that the operation of the dams was carried on negligently in that large quantities of water were released through the gates of the dams, thus flooding plaintiffs' properties. Defendant denied negligence in the operation of the dams. The Supreme Court of Arkansas, in affirming the trial court's verdict for defendant, ruled that in the absence of a finding of negligence, a dam owner has the right to release impounded waters at such times and in such quantities as are reasonably necessary for the operation of the dam. Downstream property owners hold their land sub-

:t to these rights of the dam owner. Since no find- g of negligence was made at trial, defendant was t liable for the damages to plaintiffs' lands. arker-Florida)
70-08575

RASSY LAKE AND TYRONZA DRAINAGE ST NO 9 OF MISSISSIPPI COUNTY V RAINAGE DIST NO 17 OF MISSISSIPPI OUNTY (JOINT FUNDING FOR LEVEE CON- 'RUCTION).
0 SW2d 1007-1012 (Ark 1943).

escriptors: *Arkansas, *Drainage districts, *Con- acts, *Levees, Flood control, Earthworks, Bar- ers, Flood protection, Surface waters, Regions, overnments, Federal government, United States, onstruction, Repayment contracts, Legal aspects, isements, Judicial decisions, Controlled drainage, ainage systems, Water policy, Drainage pro- ams, Drainage engineering.

aintiff drainage district sought specific per- rmance of a contract executed between it and de- ndant drainage district. The contract provided at defendant would furnish part of the cost for e construction of a levee to be located wholly thin the boundaries of the plaintiff district. How- er, the levee was designed to protect the land in oth districts from the overflow of a river. The deral government was responsible for the con- ruction of the levee, but sharing of the expense by l benefiting parties was comtemplated. Defendant leged that the entering into the contract to pro- de money for a levee not situated within its boun- aries was an ultra vires act and that the contract ould be declared void. Affirming the lower court ecision for plaintiff, the Supreme Court of Arkan- s ruled that such action taken by a drainage dis- ict was within the scope of the legislation creating e district, and the defense of ultra vires was not roper. The decree granting specific performance f the contract was affirmed. (Barker-Florida)
70-08577

ARAMORE V STATE (DAM FAILURE AUSED BY UPSTREAM RELEASE OF EXCES- IVELY LARGE QUANTITIES OF WATER AND ESULTING THERMAL EXPANSION OF ICE).
58 App Div 930, 16 NYS2d 551-552 (1939).

escriptors: *New York, *Dam failure, *Thermal xpansion, *Ice loads, Ice, Dams, Blowouts, racking, Rupturing, Discharge (Water), New ork State Barge Canal, Streams, Damages, Judi- ial decisions, Legal aspects, State governments, emedies, Adjudication procedure, Expansion, hannels, Impoundments, Impounded waters, anals, Relative rights.
dentifiers: *Negligence.

Defendant state of New York, without taking into onsideration the fact that the Irondequoit Creek bove claimant's dam was frozen to a depth of bout two feet, released into the Creek from the lew York State Barge Canal large and unusual uantities of water. The large quantities of water nd thermal expansion of ice against the dam aused the dam to fail, and claimant brought action o recover damages. In reversing the lower court ecision for claimant, the appellate court held per uriam that evidence supported a finding of egligence on defendant's part. However, clai- nant's recovery was precluded by his contributory egligence. Claimant had failed to maintain, as he ad done in previous years, a channel in the ice in ront of his dam. Such channel was necessary to ermit excessive quantities of water to flow over he dam and to prevent thermal expansion of ice. (Marsee-Florida)
W70-08582

NIGHTENGALE V STATE (NEGLIGENT IN- CREASE IN FLOWAGE BY STATE).

41 NYS2d 147-148 (App Div 1943).

Descriptors: *New York, *Adjudication procedure, *Alteration of flow, *Flooding, New York State Barge Canal, Remedies, Damages, Livestock, Real property, Legal aspects, Judicial decisions, Canals, Streams, Overflow, Diversion, Land tenure, Flow augmentation, Reservoirs, Streamflow, Water levels, Water level fluctuations, State governments.
Identifiers: *Negligence.

Claimants brought action against defendant state to recover for damages to their real property and livestock caused by overflow and flooding from a creek. Defendant had diverted water from a feeder canal through the creek and into a reservoir for the New York State Barge Canal. The increased flow through the creek resulted in claimants' damages. The lower court dismissed claimants' action on the ground that claimants had not proved any negligence on the part of defendant. The appellate court reversed, holding that the evidence was sufficient, if uncontradicted or unexplained, to warrant a finding that defendant was liable. Findings to the contrary made by the lower court were against the weight of the evidence. (Marsee-Florida)
W70-08583

4B. Groundwater Management

GRAVITY INVESTIGATION OF THE WATER-BEARING STRATA IN SWAN VALLEY, MONTANA,
Montana Univ., Missoula; and Montana Water Resources Research Center, Bozeman.
For primary bibliographic entry see Field 02F.
W70-08149

THE USE OF GRAVITY SHAFTS FOR GROUNDWATER RECHARGE - PHASE I,
North Dakota Water Resources Research Inst., Fargo.
T. R. d'Errico, and M. T. Skodje.
Available from the Clearinghouse as PB-192 762, $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, Water Resources Research Institute WI-222-003-70, January, 1970. 22 p, 2 tab, 8 fig. OWRR Project B-008-NDAK (1).

Descriptors: Laboratory tests, Permeability, Turbidity, *Sedimentation, *Shafts (Excavations), Groundwater recharge, North Dakota.
Identifiers: Sheyenne River (North Dakota), *Gravity recharge, Sand-filled shafts, Clogging patterns, Air-binding.

The hydraulic characteristics of shafts consisting of uniformly graded sand were studied in the laboratory to predict their applicability for the recharge of glacially deposited aquifers overlain with impervious soils. Water containing various levels of turbidity was applied to shafts consisting of three different sizes of sand. Piezometers were used to measure the head-loss gradients. At the completion of each test, the amount of sediment trapped in the different levels of the shaft was determined. Permeabilities of the three sand sizes using clear tap water were observed to be 14,400, 4,500, and 3,400 GPD per square foot. No 'airbinding' of the shafts was noted, and the clogging of the shafts was limited to the upper three inches of the shaft. Below this layer the permeability remained constant. Field tests should be conducted to determine whether periodic restoration of the upper level of the shaft is more economical and practical than shaft abandonment and replacement. Two different shaft designs are proposed for use with these two methods of operation. The permeability of the shaft is decreased more rapidly when higher turbidities are applied. Sedimentation of the Sheyenne River water as a method for reducing the sediment loading does not appear practical except during high river stages when turbidities exceed 100 mg per liter.
W70-08152

DEVELOPMENT AND EVALUATION OF WATER HARVESTING SYSTEMS,
Arizona Water Resources Research Center, Tucson.
For primary bibliographic entry see Field 03B.
W70-08153

EVALUATION OF THE SOCIAL IMPACT OF RESERVOIR CONSTRUCTION ON THE RESIDENTIAL PLANS OF DISPLACED PERSONS IN KENTUCKY AND OHIO,
Kentucky Water Resources Inst., Lexington.
For primary bibliographic entry see Field 06B.
W70-08155

USE OF GROUNDWATER FOR IRRIGATION, SEWARD COUNTY, NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
J. M. Jess.
Nebraska Water Survey Paper 25, University of Nebraska, March 1970. 24 p, 4 fig, 5 tab, 7 ref, append.

Descriptors: *Groundwater, *Water utilization, *Withdrawal, *Nebraska, *Irrigation water, Water resources, Water wells, Water yield, Aquifers, Water costs, Economics.
Identifiers: Seward County (Neb).

Irrigation is the principal use of groundwater in Seward County. Domestic, stock, and public supply requirements additionallly contribute to the total demand for groundwater. Increased groundwater use has resulted in a general decline of groundwater levels (3 to 10 feet), mostly in upland areas. Irrigation with groundwater has developed rapidly in Seward County. Pump irrigation has made possible a vigorous, expanding economy. In 1968, 550 wells supplied water to irrigate about 56,000 acres. Average amount of water pumped per well was 76.8 acre-feet. Average pumping cost per acre-foot was $19.60. Corn is planted to 59 percent of the irrigated acreage. Average corn yield was 115 bushels per acre compared to 60 bushels on dry land. Net returns, in dollars, of irrigated and nonirrigated crops are compared. (Knapp-USGS)
W70-08179

WATER RELATIONS OF A PROFILE-MODIFIED SLOWLY PERMEABLE SOIL,
Agricultural Research Service, Bushland, Tex. Southwestern Great Plains Research Center.
Paul W. Unger.
Soil Science Society of America Proceedings, Vol 34, No 3, p 492-495, May-June 1970. 4 p, 6 tab, 11 ref.

Descriptors: *Infiltration, *Aeration, *Soil water movement, *Deep tillage, *Soil management, Soil texture, Land management, Retention, Storage capacity, Soil strength, Porosity.
Identifiers: Southern High Plains (Tex).

A study was conducted with samples obtained from Pullman silty clay loam modified to 90 and 150 cm with a large ditching machine to determine the potential for increasing water intake, retention, and storage by profile modification, and to characterize the modified soil. Profile modification to 90 and 150 cm effectively disrupted the slowly permeable horizon of Pullman soil. Soil bulk density and strength were significantly decreased, and soil porosity was significantly increased. Unmodified soil retained more water on a volumetric basis than modified soil at 1/3- and 15-bars tension, but plant-available water as estimated from the 1/3- and 15-bar values was not altered by modification. The lower water contents of the modified soil at low tensions provided for potentially greater aeration. Water entered modified soil more rapidly than unmodified soil under field conditions. (Knapp-USGS)
W70-08224

A MARYLAND COASTAL AQUIFER,
Maryland State Geological Survey, Baltimore.
For primary bibliographic entry see Field 02L.
W70-08227

STATISTICAL ANALYSIS OF GROUNDWATER USE AND REPLENISHMENT,
Missouri Univ., Rolla. Dept. of Geological Engineering; and Colorado State Univ., Ft. Collins. Dept. of Geology.
John D. Rockaway, Jr., and Robert B. Johnson.
Water Resources Bulletin, Vol 6, No 3, p 408-423, May-June 1970. 16 p, 8 fig, 8 ref.

Descriptors: *Water resources development, *Groundwater, *Water table, *Hydrogeology, *Statistical methods, Water levels, Potentiometric level, Indiana.
Identifiers: *Trend surface analysis.

A statistical technique which offers considerable promise in groundwater studies is the fitting of polynomial trend-surfaces to groundwater data and studying the variations in the surfaces and the residuals from these surfaces over a period of time. The application of trend-surface analysis to groundwater study is based on the premise that the piezometric surface or water table can be approximated by a mathematically computed polynomial surface of the water levels of the wells in the aquifer. The evaluation of trend surface analysis application in groundwater investigations involves a study of the relationship existing between the trend surfaces and the actual groundwater surface and a study of the potential use of the residuals from the trend-surfaces to assist in the location of favorable sites for future development of groundwater resources. The conclusions from the trend surface analysis were compared with conclusions from an independent survey of groundwater conditions. (Knapp-USGS)
W70-08231

BROCK V PORTER (RIGHTS TO WELL WATER PURSUANT TO WRITTEN CONTRACT).

220 N C 28, 16 SE2d 410-411 (1941).

Descriptors: *North Carolina, *Water contracts, *Wells, *Domestic water, Water utilization, Assessments, Claims (Contracts), Contracts, Compensation, Fixed costs, Supply contracts, Legal aspects, Judicial decision, Grants, Relative rights, Adjudication procedure, Water rights, Land tenure, Real property.

The plaintiff and the defendant were adjacent landowners. Pursuant to a written contract between the plaintiff and the defendant's successors in title, the plaintiff granted well water rights for household purposes to the then owners of the land and to subsequent parties occupying the land. Payment for the water rights was to be one dollar per month. There was one dwelling house on the premises when the defendant bought the property. The defendant subsequently constructed a second dwelling house thereon and sought to use the well water for this house also. Plaintiff brought action to determine the rights under the contract. The lower court held that the plaintiff was required to furnish water for one dwelling only. The appellate court reversed, holding that the contract was clear on its face. The plaintiff was to furnish water for household use to the occupiers of this land without limit as to the number of dwellings to be served. (Price-Florida)
W70-08263

LEE V MUT BENEFIT LIFE INS CO (PRESCRIPTIVE RIGHT TO USE OF WELL).
187 SE 66 (Ga 1936).

Descriptors: *Georgia, *Prescriptive rights, *Easements, *Water wells, Land tenure, Real property, Water supply, Competing uses, Relative rights, Water demand, Water utilization, Wells, Subsurface waters, Percolating water, Adjudication procedure.

Plaintiff sought to establish a right to use water from a well owned by defendants. The court held that the allegation that defendants knew that plaintiffs were using water from the well was not sufficient to show an easement by prescription in the well. The allegation was insufficient and immaterial without further evidence tending to show that plaintiff had an easement. The court dismissed the petition on a general demurrer. (Hubener-Florida)
W70-08327

WATER RESOURCES OF THE ARID LANDS,
Aberdeen Univ. (Scotland).
Kenneth Walton.
In: The Arid Zones, Chapter 5, p 101-115. Chicago, Aldine Publishing Company, 1969. 175 p, 11 fig, 185 ref.

Descriptors: *Arid lands, *Water resources, *Surface waters, *Subsurface waters, *Aquifers, Groundwater, Perennial streams, Water resources development, Hydrogeology, Water sources, Groundwater basins, Groundwater recharge, Groundwater reservoirs, Deserts, Water yield, Saline water, Salinity, Limiting factors.

This chapter deals with groundwater and perennial rivers, the two major sources of moisture for arid lands. The author discusses the origin, structure, and location of the various aquifers of the arid zones. He considers sustained yield and saline water the most important problems to be confronted when developing desert aquifers. Arid lands which are watered by perennial streams are touched on briefly. These areas, such as the lands along the Tigris-Euphrates, Nile, Indus, and Colorado-Gila, use dams and other devices to even out the moisture regimes of rivers and thereby regulate the availability of water. There is no doubt that water and its availability will continue to be the determining factor in the development of deserts. (Carr - Arizona)
W70-08351

THE RAFT RIVER BASIN, IDAHO-UTAH, AS OF 1966: A REAPPRAISAL OF THE WATER RESOURCES AND EFFECTS OF GROUNDWATER DEVELOPMENT,
Geological Survey, Boise, Idaho.
E. H. Walker, L. C. Dutcher, S. O. Decker, and K. L. Dyer.
US Geological Survey Open-file report, April 1970. 116 p, 23 fig, 11 tab, 27 ref.

Descriptors: *Hydrogeology, *Groundwater basins, *Idaho, Aquifers, Irrigation water, Water resources development, Water levels, Water yield, Water level fluctuations, Irrigation, Water balance, Surface-groundwater relationships.
Identifiers: Raft River Basin (Idaho).

Much arable land in the Raft River Basin, Idaho lacks water for irrigation, and the potentially irrigable acreage far exceeds the amount that could be irrigated with the basin's 140,000 acre-feet estimated annual water yield. Pumping more groundwater is possible only if large additional groundwater storage depletion can be tolerated. Precipitation ranges from less than 10 inches on the valley floor to more than 30 inches at some places in the mountains. Irrigation with groundwater is widely practiced and about 69,000 acres were irrigated partly or wholly with groundwater in 1966. Basalt lavas of the Snake River Group yield water where they occur below the water table. A few wells that penetrate limestone obtain substantial supplies from crevices. Transmissivity of the composite aquifer is estimated to vary from about 10,000 gpd/ft to more than 45,000 gpd/ft. Surface outflow of the Raft River to the Snake River now amounts to only about 1,900 acre-feet per year, a decline of about 15,000 acre-feet a year from the estimated original average outflow prior to irrigation. Consumption of groundwater for irrigation averages about 1.6 feet per acre annually. The depletion of groundwater storage during the years 1952 to 1965 was approximately 410,000 acre-feet. By the end of 1966 it was nearly 515,000 acre-feet. (Knapp-USGS)
W70-08466

RECORDS OF WATER LEVELS AND CHEMICAL ANALYSES FROM SELECTED WELLS IN PARTS OF THE TRANS-PECOS REGION, TEXAS, 1965-68,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W70-08480

TRANSMISSIVITY AND STORAGE COEFFICIENT OF AQUIFERS IN THE FOX HILLS SANDSTONE AND THE HELL CREEK FORMATION, MERCER AND OLIVER COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, N. Dak.
For primary bibliographic entry see Field 02F.
W70-08485

PRELIMINARY ANALYSIS OF RATE OF MOVEMENT OF STORM RUNOFF THROUGH THE ZONE OF AERATION BENEATH A RECHARGE BASIN ON LONG ISLAND, NEW YORK,
Geological Survey, Mineola, N.Y.
For primary bibliographic entry see Field 02F.
W70-08486

SLOSS-SHEFFIELD STEEL AND IRON CO V WILKES (DAMAGES FROM DRAINAGE OF SURFACE AND PERCOLATING WATERS).

165 So 764-772 (Ala 1936).

Descriptors: *Alabama, *Reasonable use, *Relative rights, *Mining, Excavation, Mining engineering, Underground, Underground structures, Safety, Damages, Cracks, Surface waters, Industries, Percolating water, Subsurface waters, Springs, Spring waters, Wells, Judicial decisions, Legal aspects, Water sources, Land use.

Plaintiff land owner sought to recover damages which resulted from defendant corporation's drainage of surface water from springs and wells located on plaintiff's land. Plaintiff alledged that the drainage occurred when the roofs of two mines operated by defendant collapsed, thus destroying the percolating water which served as the supply for plaintiff's springs and wells. It was alleged that such collapse was the result of negligence by defendant. Defendant contended that there was no violation of due care and that the mining operations did not constitute an unreasonable interference with the use of the water by both parties. In reversing the trial court's judgment for the plaintiff, the Supreme Court of Alabama adopted the reasonable use doctrine whereby a land owner has the right to reasonable use of the water on his land even though the underground waters of neighboring property may be interfered with or diverted. The mining operations were held to be a reasonable use of defendant's property. (Barker-Florida)
W70-08552

4C. Effects on Water of Man's Non-Water Activities

HYDROLOGIC AND BIOTIC EFFECTS OF GRAZING VERSUS NONGRAZING NEAR GRAND JUNCTION, COLORADO,
Geological Survey, Denver, Colo.
Gregg C. Lusby.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC,

0402 - Price $3.25. In: Geological Survey esearch 1970, Chapter B, US Geological Survey rofessional Paper 700-B, p B232-B236, 1970. 5 p, fig, 4 ref.

escriptors: *Rainfall-runoff relationships, *Runoff, *Sediment yield, *Grazing, *Land manageent, Grasslands, Hydrogeology, Water conservaon, Water quality, Water yield, Infiltration, echarge, Soil conservation.
dentifiers: Grant Junction (Colo), Land conservaon.

he effect of grazing on the hydrology of saltesert type rangeland has been studied near Grand unction, Colo, for the past 14 years. Measureents of precipitation, runoff, erosion, and vegetaon have been made in four pairs of watersheds. Dne of each pair has been grazed by cattle and heep as is normal in the region, and the other has ot been used since the beginning of the study. Measurements made 10 years apart show that all our grazed watersheds have had a slight increase in he amount of bare soil and rock and a decrease in round cover; cover on ungrazed watersheds has emained virtually unchanged. Runoff in the unrazed watersheds has been about 30 percent less han in the grazed watersheds, and sediment yield as been about 45 percent less. The greatest hange in each of the relationships occurred about years after livestock was excluded from one vatershed of each of the pairs. Preliminary studies ndicate that within areas of similar physiography, unoff is directly related to the percentage of bare oil present on a watershed. (Knapp-USGS)
W70-08494

ROUTING MODIFICATIONS TO SUBURBAN DESIGN HYDROGRAPHS,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 04A.
W70-08540

MISSOURI PAC RR V BARRON (LIABILITY FOR FLOODING RESULTING FROM OBSTRUCTION OF STREAM BY RAILROAD BRIDGE).

117 SW2d 15-18 (Ark 1938).

Descriptors: *Arkansas, *Flooding, *Bridges, *Obstruction to flow, Flood damage, Damages, Overflow, Floods, Streams, Judicial decisions, Railroads, Stream flow, Flow, Running waters, Drainage, Alteration of flow, Legal aspects, Judicial decisions.

In an action for damages to realty, plaintiff contended that defendant railroad company maintained a railroad bridge which impeded the natural flow of a stream, which passed through plaintiff's land, and thereby flooded such land. Defendant contended on appeal that the jury verdict for plaintiff was not based on substantial evidence. The court reviewed the record and found testimony to the effect that the trestle of the bridge was so constructed down into the bank of the stream so as to reduce the size of the channel through which the water flowed, resulting in an obstruction to the free flow of the stream. Such evidence was held to be substantial enough to support the jury's verdict. (Snow-Florida)
W70-08567

4D. Watershed Protection

STUDY OF WATERSHED HYDROLOGY BY THE WATERSHED EXPERIMENTATION SYSTEM,
Illinois Univ., Urbana. Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 02A.
W70-08182

FOREST HYDROLOGY RESEARCH IN WATERSHED MANAGEMENT,
Oregon State Univ., Corvallis. Dept. of Forest Hydrology and Watershed Management.
James T. Krygier.
In: Water Studies in Oregon, Oregon State University Water Resources Research Institute Fall Quarter 1969 Seminar WR 012.69, Corvallis, p 55-68, January 1970. 14 p, 4 fig, 16 ref.

Descriptors: *Watershed management, *Lumbering, *Water yield improvement, *Water pollution control, Hydrographs, Rainfall-runoff relationships, Soil-water-plant relationships.
Identifiers: *Forest hydrology.

Oregon State University School of Forestry forest watershed management projects reviewed include: (1) comparative water use of different forest stands; (2) the relationship between forest cutting and peak stream-discharges; (3) logging and effects on sediment production; and (4) the relationship between vegetative removal and the water temperature regimes of small streams. Seasonal differences were found in the amount of water transpired and evaporated by stands of Douglas-fir and Oregon white oak. Logging road building could not be detected in the hydrograph when roads constituted less than about 3.5% of a drainage. Peaks were increased significantly at 7.0% of a drainage area and when clearcutting was a large fraction of a drainage basin. Annual sediment loads varied not only because of changing erosion but also the alterations in streamflow regime. Sediment yields were increased significantly for the first two years after logging. After logging there was no apparent change in temperature characteristics of the patch-cut watershed with streamside strips, whereas the temperature of almost fully exposed streams in completely clearcut areas reached a maximum of 85 deg F, an increase of 28 deg F over the pre-logging maximum. (Knapp-USGS)
W70-08474

HYDROLOGIC AND BIOTIC EFFECTS OF GRAZING VERSUS NONGRAZING NEAR GRAND JUNCTION, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 04C.
W70-08494

SEIDEN V PASSAIC VALLEY WATER COMM'N (LIABILITY FOR SEDIMENT IN WATER SUPPLY).
For primary bibliographic entry see Field 05G.
W70-08519

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

AUTOMATED POTENTIOMETRIC TECHNIQUES FOR THE ON-SITE MONITORING OF ANION CONCENTRATIONS IN WATER,
Missouri Water Resources Research Center, Columbia.
Stanley E. Manahan.
Available from the Clearinghouse as PB-192 809, $3.00 in paper copy, $0.65 in microfiche. Completion Report, 1970. 17p, 2 tab, 6 ref. OWRR Project B-023-MO (4).

Descriptors: *Water analysis, *Analytical techniques, *Nitrates, *Electrodes, Ions, Fluorides, Microbiology, Bacteria, Volumetric analysis, Water chemistry, Pollutant identification, *Monitoring.
Identifiers: Ion-selective electrodes, Standard addition, *Potentiometry.

Characteristics of several of the new non-glass ion-selective electrodes and of several reference electrodes were studied in detail with particular emphasis upon the nitrate ion-selective electrode. A new high accuracy standard addition technique for the potentiometric determination of nitrate ion in a cell without liquid junction using the fluoride electrode as a reference was developed. This method eliminates the liquid junction and dilution and activity coefficient changes cancel. The method is applicable to all monovalent anions for which an electrode is available and enables the determination of anion concentrations to within 1% relative accuracy. Low temperature potentiometric titrations of perchlorate and tetrafluoroborate ions with tetraphenylarsonium chloride and ion-selective electrodes were investigated and found to give high accuracy and reasonably good sensitivity for these ions. The nitrate electrode was used to follow nitrate ion concentration in microbial cultures. It was found to be useful for following nitrate ion reduction in situ. (See also W70-08157 thru W70-08160) (Manahan-University of Missouri)
W70-08156

NITRATE ION-SELECTIVE ELECTRODE IN MICROBIAL MEDIA,
Missouri Water Resources Research Center, Columbia.
Stanley E. Manahan.
Applied Microbiology, Vol. 18, p 479-481, Sept., 1969. OWRR Project B-023-MO.

Descriptors: Bacteria, *Nitrates, *Electrodes, *Microbiology, Ions, Nitrites, Pollutant identification, Analytical techniques, *Chemical analysis.
Identifiers: *Ion-selective electrodes.

A nitrate ion-selective electrode has been used to follow the kinetics of the reduction of nitrate to nitrite by a bacillus isolated from the rumen of a sheep. The electrode system and the microbial culture were found to be quite compatible, although the formation of nitrite limits the utility and precision of the measurement. The formation of nitrite was followed simultaneously by a colorimetric method. Nitrate was converted quantitatively to nitrite. The rate of the reaction was found to increase to a plateau value, then drop abruptly when the nitrate was exhausted. (See also W70-08158) (Manahan-University of Missouri)
W70-08157

FLUORIDE ELECTRODE AS A REFERENCE IN THE DETERMINATION OF NITRATE ION,
Missouri Water Resources Research Center, Columbia.
Stanley E. Manahan.
Analytical Chemistry, Vol. 42, p 128-129, January, 1970. OWRR Project B-023-MO.

Descriptors: *Nitrates, *Fluorides, *Analytical techniques, *Water analysis, *Electrodes, Ions, Volumetric analysis, Water chemistry, Pollutant identification.
Identifiers: Potentiometry, Ion-selective electrodes, Standard addition.

The fluoride ion-selective electrode was used as a reference electrode for the standard addition determination of nitrate ion with the nitrate ion-selective electrode. The nitrate electrode was hooked to the measuring side of an expanded-scale pH meter and the fluoride electrode was connected to the reference side. The potential of the fluoride electrode was poised by the addition of a low concentration of fluoride ion to the solution to be measured. At the concentration levels used, the nitrate electrode does not respond to fluoride ion nor does the fluoride electrode respond to nitrate ion. The electrode system is very stable and the liquid junction is eliminated. The concentration of nitrate ion is determined by adding a measured amount of standard nitrate to a known volume of unknown nitrate solution and calculating the original nitrate ion concentration from the shift in potential. Dilution effects and activity coefficient changes cancel. Nitrate ion concentrations in the range 0.00005 to 0.01 M were determined with a relative accuracy

within 1%. The technique is applicable to other monovalent anions for which electrodes are available. (See also W70-08159) (Manahan-University of Missouri)
W70-08158

ION-SELECTIVE ELECTRODES FOR NITRATE ANALYSIS,
Missouri Water Resources Research Center, Columbia.
Stanley E. Manahan.
Proceedings, 3rd Annual Conference 'Trace Substances in Environmental Health-III, University of Missouri, Columbia, p 353-357, June 24, 26, 1969. OWRR Project B-023-MO.

Descriptors: *Nitrates, *Fluorides, *Analytical techniques, Water analysis, *Electrodes, Ions, Water chemistry, Pollutant identification.
Identifiers: *Ion selective electrodes, Potentiometry, Standard Addition.

A standard addition analysis technique has been developed for nitrate where the fluoride ion-selective electrode is used as a reference electrode in solutions spiked with a low concentration of fluoride ion. The electrode system is more stable than the conventional system. Since a reference with liquid junction is not used, errors arising from liquid junction potential are eliminated. Dilution from the addition of standard affects both electrodes equally. Dilution corrections need not be made and a relatively large volume of standard may be added. Changes in ionic strength resulting from the addition of the standard affect the activity coefficients of both the fluoride and nitrate ions similarly and no errors are produced by the change in activity coefficients. Determinations of nitrate in the concentration range of 0.00005 M to 0.01 M have given reproducable results within plus or minus 1% and relative standard deviations of 0.5%. (See also W70-08160) (Smith-University of Missouri)
W70-08159

LOW TEMPERATURE PRECIPITATION TITRATION OF PERCHLORATE AND TETRAFLUOROBORATE WITH TETRAPHENYLARSONIUM CHLORIDE AND ION-SELECTIVE ELECTRODES,
Missouri Water Resources Research Center, Columbia.
Michael J. Smith, and Stanley E. Manahan.
Analytica Chimica Acta, Vol. 48, p 315-319, 1970. OWRR Project B-023-MO.

Descriptors: *Volumetric analysis, *Analytical techniques, Electrodes, Ions, *Chemical precipitation, Pollutant identification, Chemical analysis.
Identifiers: *Perchlorate, *Tetrafluoborate, Precipitation titrations.

Perchlorate and tetrafluoroborate have been determined at low concentrations by precipitation titration with tetraphenylarsonium chloride, the appropriate anion-selective electrodes being used to follow the course of the titration potentiometrically. A low temperature, 2 deg, was employed to sharpen the titration curves, thus resulting in greater accuracy and lower limits of analysis. As little as 0.05 mmol of perchlorate and 0.25 mmol of tetrafluoroborate have been determined to within 1% relative accuracy. These limits could easily be extended by a factor of 10 by using a miniaturized titration apparatus. (See also W70-08156) (Manahan-university of Missouri)
W70-08160

SULFIDE TO SULFATE REACTION MECHANISM--A STUDY OF THE SULFIDE TO SULFATE REACTION MECHANISM AS IT RELATES TO THE FORMATION OF ACID MINE WATERS.
Ohio State Univ. Research Foundation, Columbus
For primary bibliographic entry see Field 05G
W70-08161

SENSITIVITY OF BENTHIC MICROFLORA TO POLLUTION GRADIENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
For primary bibliographic entry see Field 05C.
W70-08164

THE PRACTICE OF WATER POLLUTION BIOLOGY,
Federal Water Pollution Control Administration, Washington, D.C. Div. of Technical Support.
Kenneth M. Mackenthun.
Report for sale from Superintendent of Documents, US Government Printing Office, Wash, DC, 20402 - Price $1.50. Federal Water Pollution Control Administration Publication, Wash, DC, 1969. 281 p, 85 fig, 15 tab, 392 ref.

Descriptors: *Water pollution, *Investigations, *Water quality, *Water pollution effects, Bioindicators, Water pollution control, Pollutant identification, Surveys, Sampling, Data collections, Environmental effects, Ecology, Biological communities, Microbiology, Eutrophication, Water supply, Sewage treatment.
Identifiers: Water pollution biology.

This book presents some practical water pollution biological field investigative techniques and practices, procedures to solve problems, data analyses, interpretation and display, and the development and writing of the investigative report. It is written principally for the biologist inexperienced in these activities, and for sanitary engineers, chemists, attorneys, water pollution control administrators, and others. Aquatic environments, their biotic constituents, and the effects of various pollutants upon them are considered. Field investigations that include forming the study objectives, planning the field study, station selection, sample collection and examination, data analyses and interpretation, and reporting the results are described. Examples of field studies on specific water pollution problems are given with the collected data presented in many graphic variations. Examples of field investigations, including data collection, analyses, interpretation and display are given for organic wastes, silts, toxic wastes, acid mine drainages, eutrophication, and radioactive wastes. The biology of municipal water supplies and sewage treatment, biological nuisances, and slimes are discussed. (Knapp-USGS)
W70-08197

CLASSIFICATION OF ORGANIC POLLUTION IN SURFACE WATERS,
Research Inst. for Industrial Water Treatment, Prague (Czechoslovakia).
A. Brodsky, J. Prochazka, and H. Vydrova.
Journal of American Water Works Association, Vol 62, No 6, p 386-390, June 1970. 5 p, 12 fig, 13 ref.

Descriptors: *Organic matter, *Humus, *Sulfite liquors, *Analytical techniques, Chromatography, Chemical analysis, Water quality, Water analysis, Water pollution, Pollutant identification.
Identifiers: Oden's classification.

Oden's classification of humic substances in natural waters was compared with the elution patterns of these materials on Sephadex. The elution patterns of humic groups in the sense of Oden's systematics were shown using Sephadex G 75 grade. Basic peat extracts were prepared using different manners of preparation to duration of extraction period, buffer capacity and ion strengths of extraction agents. Isolation procedures, either precipitation or dissolving of precipitate followed by considerable changes in pH value or alcohol extractions influenced the proportions of fractions with smaller size particles. Drying of samples had a still more disturbing effect. It is possible to separate several fractions from humic substances using the G 75 grade without having any substantial portions of substances that were not displaced from the column. Under standardized conditions the elution curves may be used for qualitative--and, to a certain extent quantitative--estimation of individual groups of humic substance participation in the sample. (Knapp-USGS)
W70-08236

PRELIMINARY ANALYSES OF THE WASTE WATER AND ASSIMILATION CAPACITIES OF THE ANACOSTIA TIDAL RIVER SYSTEM,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
Norbert A. Jaworski, Leo J. Clark, and Kenneth D. Feigner.
Federal Water Quality Administration, Chesapeake Technical Support Lab Report No 39, April 1970. 57 p, 16 fig, 4 tab, 5 ref, 3 append.

Descriptors: *Estuaries, *Water pollution effects, *District of Columbia, Tidal effects, Nutrients, Eutrophication, Water quality, Water pollution control, Surveys, Investigations, Path of pollutants, Sampling, Water analysis, Algae, Coliforms, Dissolved oxygen.
Identifiers: *Anacostia River.

A preliminary analysis of waste water assimilation and transport capacities was made of the tidal portion of the Anacostia River, Washington, D.C. The mean streamflow in the basin is about 122 cfs and the 7-day low flow with a recurrence interval of once-in-ten-years is 8 cfs. Based on 1969 sampling data, the water quality conditions in the tidal river under summer conditions are typified by: (a) Low dissolved oxygen concentrations often falling below 2.0 mg/l, (b) high fecal coliform densities often above 10,000 MPN/100 ml, (c) high turbidity levels especially during periods of high runoff, and (d) high nutrient concentrations. The most pronounced degradation results from storm sewer and combined sewer overflows and defective sanitary sewer systems. Mathematical model investigations of the Anacostia River indicate that waste water assimilation and transport capabilities for large advective flows are most sensitive to the decay rate of a pollutant and not to the dispersion effect of the tidal system. The sensitivity of the decay rate is a result of the long detention time, while the effect of dispersion is diminished by the pronounced advective movement. The tidal system capability to assimilate oxygen-demanding waste water is currently being exceeded. If waste water were subjected to high carbonaceous and nitrogenous BOD removal and if the effluent is aerated to 6.0 mg/l, the present water quality of the Anacostia River would be enhanced. (Knapp-USGS)
W70-08249

INCREASING THE RELIABILITY OF EXPERIMENTAL RESULTS ARRIVED AT IN STUDIES ESTABLISHING HYGIENIC STANDARDS FOR HARMFUL SUBSTANCES IN BODIES OF WATER,
S. N. Cherkinskiy, and G. N. Krasovskiy.
Available from the Clearinghouse as PB-185 824T, $3.00 in paper copy, $0.65 in microfiche. Translated from Russian. In: USSR Literature on Water Supply and Pollution Control, CFSTI, Vol 10, 1969, p 4-13.

Descriptors: *Water pollution, *Organic compounds, *Analytical techniques, *Pollutants, Methodology, Toxicity, Organic wastes, Organoleptic properties, Water pollution effects.

Common methodological errors in the analysis of harmful substances in water are discussed. The discussion includes: (1) Physical and chemical properties of pollutants; (2) stability of pollutants in water; (3) study of the organoleptic properties of water; (4) effects of pollutants on the overall sanitary regime of natural water bodies; and (5) sanitary toxicological investigations. Evaluation of pollutant data and interpretation of results are briefly mentioned. (Carstea-USGS)
W70-08285

EXPERIMENTAL BASIS FOR THE DETERMINATION OF MAXIMUM PERMISSIBLE ANILINE CONCENTRATION IN WATER BODIES,
A. I. Cooper, and V. P. Ozerova.
Available from the Clearinghouse as PB-185 824T, $3.00 in paper copy, $0.65 in microfiche. Translated from Russian. In: USSR Literature on Water Supply and Pollution Control, CFSTI, Vol 10, 1969, p 93-101.

Descriptors: *Water pollution, *Pollutants, *Analytical techniques, Methodology, Organoleptic properties, Organic compounds, Toxicity, Odor, Taste, Color, Biochemical oxygen demand.
Identifiers: *Aniline.

A chemically pure sample of aniline was used to determine its maximum permissible concentration and stability in water. Taste, odor and color of polluted water were changed by aniline. The threshold concentration for taste and odor was found to be 50-100 mg/liter, while that for color was 200 mg/liter. Aniline undergoes oxidation by biochemical processes and the biochemical oxygen demand is increased. The critical levels of biochemical oxygen demands can be avoided if the aniline concentration does not exceed 0.5 mg/liter. Based on the toxicological index, the maximum permissible aniline concentration in water was recommended as 0.1 mg/liter. (Carstea-USGS)
W70-08286

EXPERIMENTAL DETERMINATION OF MAXIMUM PERMISSIBLE POTASSIUM AND AMMONIUM THIOCYANATE CONCENTRATIONS IN BODIES OF WATER,
Ya. M. Kostovetskiy, K. F. Meleschenko, Z. I. Zholdskova, R. K. Rozhkovetskaya, and A. I. Lur'ye.
Available from the Clearinghouse as PB-185 824T, $3.00 in paper copy, $0.65 in microfiche. Translated from Russian. In: USSR Literature on Water Supply and Pollution Control, CFSTI, Vol 10, 1969, p 102-109.

Descriptors: *Water pollution, *Pollutants, *Analytical techniques, Methodology, Organoleptic properties, Organic compounds, Toxicity, Odor, Taste, Color, Biochemical oxygen demand.
Identifiers: Potassium thiocyanate, Ammonium thiocyanate, Hydrocarbon metabolism, Maximum permissible concentration.

Thiocyanate compounds have little effect upon water odor, color or transparency. The threshold of taste perception is 100 mg/liter. Biochemical oxygen demand showed an increase with increasing concentration of thiocyanates. Body weight, peroxydase activity of the blood, hydrocarbon metabolism and the morphology of the internal organs are not adversely affected by does of thiocyanates which varied between 0.5 and 0.0005 mg/kg. The maximum permissible concentration of thiocyanates in natural water is recommended at 0.1 mg/liter. (Carstea-USGS)
W70-08287

BASIC EXPERIMENTS FOR THE DETERMINATION OF MAXIMUM PERMISSIBLE NORSULFAZOLE CONCENTRATION IN WATER BODIES,
O. N. Yelizarova, A. I. Kuper, L. V. Zhidkova, A. A. Khutoryanskiy, and K. O. Lastochkina.
Available from the Clearinghouse as PB-185 824T, $3.00 in paper copy, $0.65 in microfiche. Translated from Russian. In: USSR Literature on Water Supply and Pollution Control, CFSTI, Vol. 10, 1969, p 129-136.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Analytical techniques, Methodology, Pollutants, Organic compounds, Water pollution, Theoretical analysis, Chemical reactions, Chemical degradation.
Identifiers: Nomograms.

Biochemical oxygen demand and dissolved oxygen were used to determine the maximum permissible concentration of 11 organic pollutants in open water bodies. Determination of total biochemical oxygen demand is a complex and time-consuming procedure. Therefore, a first-order monomolecular-reaction equation in which the rate of the process is proportional to the concentration of residual unreacted material is used to determine the total biochemical oxygen demand. Nomograms were devised to compute the rate constant (k) for incubation periods of 2-5 and 3-5 days. (Carstea-USGS)
W70-08290

EXPERIMENTAL DETERMINATION OF THE MAXIMUM PERMISSIBLE CONCENTRATION OF PROPYLBENZENE IN WATER BODIES,
R. D. Smirnova, and I. M. Stepanova.
Available from the Clearinghouse as PB-185 824T, $3.00 in paper copy, $0.65 in microfiche. Translated from Russian. In: USSR Literature on Water Supply and Pollution Control, CFSTI, V. 10, 1969, p 122-128.

Descriptors: *Water pollution, *Pollutants, *Analytical techniques, Methodology, Organoleptic properties, Taste, Odor, Color, Toxicity, Biochemical oxygen demand.
Identifiers: *Propylbenzene.

The threshold concentration of propylbenzene with respect to odor perception is 0.2 mg/l. The self-purification processes of water containing up to 10 mg/l of propylbenzene were not affected. The effect of 0.2 mg/l of propylbenzene upon biochemical oxygen demand was slight. The toxicological threshold concentration of propylbenzene is 0.5 mg/l which is also the maximum permissible concentration. (Carstea-USGS)
W70-08291

RESIDUES IN FISH, WILDLIFE, AND ESTUARIES - CHLORINATED HYDROCARBON PESTICIDES IN CALIFORNIA BAYS AND ESTUARIES,
California State Dept. of Fish and Game, Menlo Park, Calif. Marine Resources Operations.
John C. Modin.
Pesticides Monitoring Journal, Vol. 3, No. 1, June 1969. p 1-7, 1 fig, 6 tab, 7 ref.

Descriptors: *Pesticide residues, *Monitoring, *DDT, *Dieldrin, Endrin, Pesticide drift, Chlorinated hydrocarbon pesticides, *Estuaries, Oysters, Clams, Bottom sediments, Chinook Salmon, Shellfish, Shrimp, Crabs, Gas chromatography, Fish eggs.
Identifiers: DDD, DDE, *Pesticide monitoring, Mussels, Halibut, Flounder, Seasonal variations, *California estuaries, Humboldt Bay, Morro Bay.

As part of a nationwide program to monitor organochlorine pesticide residues in estuaries, the U. S. Bureau of Commercial Fisheries in January 1966 contracted to the California Department of Fish and Game the responsibility to monitor selected estuaries in California for pesticides. Analyses of oysters, mussels, and clams sampled at points of interest within each estuary revealed DDT, DDD, DDE, dieldrin, and endrin in concentrations from 10 to 3,600 ppb. Calculations are based on the laboratory wet weight of homogenized tissue. In studies of offshore exposure, high levels of DDT, DDD, and DDE were found in a king crab (2,739 ppb) and in ova from a king salmon (668 ppb). Pesticides were also measured in the ova of prawn, flounder, halibut, and sole; of these, halibut ova were the most highly contaminated, with DDE, DDD, and DDT measuring 591 ppb. (Sjolseth-Washington)
W70-08363

DISTRIBUTION OF MERCURY IN WATER, BOTTOM MUD AND AQUATIC ORGANISMS OF MINAMATA BAY, THE RIVER AGANO AND OTHER WATER BODIES IN JAPAN,
Freshwater Fisheries Research Lab., Tokyo (Japan).
Yoshihiro Matida, and Hiroshi Kumada.
Bulletin of Freshwater Fisheries Research Laboratory, Contribution no. 253, Vol 19, No. 2, 1969. p. 73-93, 6 tab, 1 fig, 30 refs.

Descriptors: *Heavy metals, *Distribution, *Water analysis, Water chemistry, Water pollution effects, Water pollution sources, *Bottom sediments, *Aquatic animals, On-site investigations, Copper, Plankton, Aluminum, Manganese, Public health, Waste water disposal.
Identifiers: *Mercury, Japan, *Minamata Bay disease, Agano River, Thallium.

The distribution of mercury and other heavy metals in water, bottom mud, and aquatic organisms was determined for Minamata Bay and other water bodies in Japan. Among the heavy metals analyzed (Mercury, Manganese, copper, iron, titanium, thalliam, and aluminum) only mercury was very high in Minamata Bay and the Agano River where minamata disease had occurred. The distribution of mercury in Minamata Bay indicated that the origin of mercury was a plant which produced acetaldehyde from acetylene and water by the catalytic action of mercuric sulfate. The authors feel that since the content of total and organic mercury is high in aquatic organisms in many Japanese waters, that monitoring, background surveys, and studies on the accumulation mechanisms of heavy metals are desirable. (Sjolseth-Washington)
W70-08369

STUDIES ON THE METABOLISM OF PENTACHLOROPHENATE, A HERBICIDE, IN AQUATIC ORGANISMS--I. TURNOVER OF ABSORBED PCP IN TAPES PHILIPPINARIUM. (In Japanese),
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture; and Tokyo Univ. of Fishery (Japan).
For primary bibliographic entry see Field 05C.
W70-08375

STUDIES ON THE METABOLISM OF PENTACHLOROPHENATE, A HERBICIDE, IN AQUATIC ORGANISMS -III. ISOLATION AND IDENTIFICATION OF A CONJUGATED PCP YIELDED BY A SHELL-FISH, TAPES PHILIPPINARUM (In Japanese),
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture; and Tokyo Univ. of Fishery (Japan).
Kunio Kobayashi, Akitake Hiroshi, and Tetuo Tomiyama.
Bulletin, Japanese Society of Scientific Fisheries, Vol. 36, No. 1, 1970, p 103-108, 11 refs, 5 figs, 3 tables.

Descriptors: Carbon radiosotopes, *Analytical techniques, Chromotography, Mode of action, *Isolation, Shell-fish.
Identifiers: *Pentachlorophenate, Carbon-14, *Tapes philippinarum, Detoxification, Biochemical change, *Biosynthesis, Identification, *Conjugated pentachlorophenate.

This paper deals with the isolation and identification of a conjugated 14C-labelled PCP-Na which is biosynthesized by the shell-fish. A PCP conjugate was isolated by treating a shell-fish culture medium with activated charcoal, followed by elution with ammonia-acetone, and finally by subjecting the eluate to silica-gel thin layer chromatography. The behaviors of the isolated conjugate in the chromatography and in the extractability with xylene were identical to those of synthesized PCP sulfate. An experimental result that the molar ratio of PCP to SO4 was about unity, evidences that the isolated PCP conjugate is a sulfate ester of PCP. It is to be concluded, therefore, that PCP can be largely detoxicated in the shell-fish by the conjugation with sulfate. (Sjolseth-Washington)
W70-08378

STUDIES ON THE METABOLISM OF PENTACHLOROPHENATE, A HERBICIDE, IN AQUATIC ORGANISMS -II. BIOCHEMICAL CHANGE OF PCP IN SEA WATER BY DETOXICATION, MECHANISM OF TAPES PHILIPPINARUM (In Japanese),
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture; and Tokyo Univ. of Fishery (Japan).
Kunio Kobayashi, Hiroshi Akitake, and Tetuo Tomiyama.
Bulletin, Japanese Society of Scientific Fisheries, Vol. 36, No. 1, 1970. p 96-102, 10 refs, 3 figs, 4 tab.

Descriptors: Carbon radioisotopes, *Biodegradation, *Analytical techniques, Shellfish, Herbicides, *Tracers, Mode of action, Distribution patterns, Sea water, Chemical properties.
Identifiers: *Pentachlorophenate, Carbon-14, *Tapes philippinarum, *Biochemical change, *Detoxification.

This paper deals with a study, using 14C-labelled PCP, on the biochemical change of PCP in the medium during the culture of Tapes philippinarum. It was elucidated that the decrease of PCP in the medium did not mean its decomposition, but its transformation some bound-form by the detoxication mechanism of the shell-fish. It was also confirmed that the excreta of shell-fish and micro-organisms in the medium played no role in the formation of the bound PCP. Although the bound PCP was not extracted with xylene from the acidified aqueous solution (0.02 N HCl) by the standard method for PCP determination, it was, however, determined as free PCP from the distillate of the steam-distillation of the acidified sample (0.6 N HCl). (Sjolseth-Washington)
W70-08379

LAKE MICHIGAN WATER QUALITY AS RELATED TO CHICAGO'S WATER TREATMENT PLANTS,
Department of Water and Sewers, Chicago, Ill.
James C. Vaughn.
A report presented at the FWPCA Four-State Conference on Pollution of Lake Michigan and Its Tributary Basin, Milwaukee, March 31, 1970. City of Chicago Department of Water and Sewers, March 31, 1970. 40 p, 16 fig, 11 tab.

Descriptors: *Lake Michigan, *Water quality, *Water works, *Water treatment, *Water supply, *Water quality control, *Lake morphology, *Water pollution, *Limnology, Water pollution effects, Pollution abatement, Lake basins, Odor, Chlorides, Sulfates, Phosphorus, Coliforms, Nitrogen, Plankton, Chemical analysis, Sampling, Monitoring.
Identifiers: *Chicago, Southern Lake Michigan, Conference on Pollution of Lake Michigan and Its Tributary Basin.

This report is the third presented at sessions of the Four-State Conference on Pollution of Lake Michigan and Its Tributary Basin. It describes the water quality of Lake Michigan and some of its tributaries, including the Indiana Harbor Ship Canal and the Calumet, Grand Calumet and Little Calumet rivers. The report focuses on the water quality of Lake Michigan in the vicinity of the South Water Filtration Plant, one of Chicago's two filtration plants. On the basis of continuing water sampling and analysis program involving studies of 24 quality parameters, the City reported that the water quality of Lake Michigan at the South Plant showed a marked improvement in 1969, except for Phosphorus, Nitrogen and Threshold Odor values. Bacteriological quality improved and plankton counts were lower, however, concentrations of inorganics increased. Costs of chemical treatments at the South Plant are tabulated. The report also includes comparisons of 1968 and 1969 water quality data for the west shore of Lake Michigan near the northern boundary of the City. A marked decline in quality, as measured by Phosphorus, Nitrogen, and Total Coliform, was evidenced. It is recommended that immediate and drastic action be taken to improve the quality of discharges to Lake Michigan along the North Shore. (Poertner)
W70-08433

SPECTROCHEMICAL DETERMINATION OF MICROGRAM QUANTITIES OF GERMANIUM IN NATURAL WATER CONTAINING HIGH CONCENTRATIONS OF HEAVY METALS,
Geological Survey, Sacramento, Calif.
Alex E. Dong.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970. Chapter B, US Geological Survey Professional Paper 700-B, p B242-B244, 1970. 3 p, 1 fig, 2 tab, 5 ref.

Descriptors: *Trace elements, *Water chemistry, *Groundwater, *Brines, *Spectroscopy, California, Analytical techniques, Chemical analysis.
Identifiers: Germanium.

A procedure is described for the chemical separation and determination of microgram quantities of germanium in water containing high concentrations of heavy metals. Before being subjected to spectrochemical determination, germanium is selectively isolated from other major and minor elements in the water in order to avoid undesirable dilution effects. The average error for eight determinations is plus or minus 9 percent, and the relative standard deviation is 8.0 percent, a level of precision satisfactory for spectrochemical determination of trace quantities of germanium. (Knapp-USGS)
W70-08496

REPORT ON DIFFERENTIAL THERMAL AND THERMOGRAVIMETRIC ANALYSIS,
Wrightsville Beach Test Facility, N.C.
For primary bibliographic entry see Field 03A.
W70-08507

QUANTITY AND CHEMICAL QUALITY OF LOW FLOW IN CIBOLO CREEK, TEXAS, MARCH 4-8, 1968,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W70-08509

DETERMINATION OF TOTAL NITROGEN, PHOSPHORUS AND IRON IN FRESH WATER BY PHOTO-OXIDATION WITH ULTRAVIOLET RADIATION,
Norsk Institutt for Vannforskning, Oslo.
A. Henriksen.
Analyst, Vol 95, No 1131, p 601-608, June 1970. 8 p, 2 fig, 5 tab, 14 ref.

Descriptors: *Chemical analysis, *Nitrogen, *Phosphorus, *Iron, *Water analysis, Oxidation, Organic matter, Chemical reactions, Ultraviolet radiation, Light.
Identifiers: Photo-oxidation analysis.

A photo-oxidation method for determining total phosphorus and nitrogen in sea water was adapted for analysis of fresh-water samples and includes the determination of total iron. Samples are subjected to ultraviolet irradiation in a photochemical reactor consisting of a high pressure mercury-arc lamp, a reactor body with twenty-four fused silica sample tubes and a cooling fan. Organically combined phosphorus and iron are converted into orthophosphate and iron (III) ions in the presence of acid and excess of oxygen after an irradiation time of 1 hour. Organonitrogen compounds and ammonia in solutions with pH range 6.5 to 9 are oxidized to nitrate and nitrite after 4 hours' irradiation in the presence of excess of oxygen. (Knapp-USGS)
W70-08513

MERCURY CONTAMINATION IN THE NATURAL ENVIRONMENT,
Bureau of Commercial Fisheries, Ann Arbor, Mich.; and Dept. of Interior, Washington, D.C. Office of Library Services.
Ruth Rehfus, Arthur H. Priddy, and Mildred E. Barnes.
Available from the Clearinghouse for Federal Scientific and Technical Information, as PB-192 910, $3.00 in paper copy, $0.65 in microfiche. Department of Interior Office of Library Services Cooperative Bibliography, July 1970. 32 p, 209 ref, index.

Descriptors: *Bibliographies, *Water pollution, *Pollutants, *Heavy metals, *Poisons, Water pollution sources, Water pollution effects, Chemical wastes, Farm wastes, Environmental effects, Wildlife, Birds, Analytical techniques, Publications, Diseases, Toxicity, Water quality.
Identifiers: Mercury, Mercury pollution.

A bibliography was made of literature concerning mercury pollution. The purpose of this bibliography is to provide access to the literature for those beginning to work on the problem. English language material relating to fish, wildlife and water pollution was given full coverage. So much literature exists on other phases such as analysis, agricultural uses, industrial health, and clinical medicine, that it could not all be included. The criteria for selection in these areas were close relationship to environmental contamination, recommendations of scientists, or the presence of literature reviews or substantial bibliographies. (Knapp-USGS)
W70-08541

5B. Sources of Pollution

SPREADING AND MOVEMENT OF OIL SPILLS,
New York Univ., Bronx. Dept. of Chemical Engineering.
Henry G. Schwartzberg.
Available from the Clearinghouse as PB-192 852, $3.00 in paper copy, $0.65 in microfiche. Water Pollution Control Research Series, March 1970. 103 p, 9 tab, 21 fig, 82 ref. FWQA Program 150-80-EPL---4/70, Contract WP 01342-01A.

Descriptors: *Oily water, *Oil-water interfaces, *Drifting (Aquatic), *Waves (Water), *Winds, Oil wastes, Oil, Water pollution control, Wind velocity, Water pollution sources, *Path of pollutants.
Identifiers: *Oil spillage, Oil spill (Spreading rates), Oil lenses, Wind drift, Wave drift.

The spreading and movement of oil spills on water were investigated. Areas for spills which form lenses were measured and correlated. Most crudes tested formed thin films, not lenses; but lens formation could be induced and spreading greatly reduced by surfactant treatment. Spreading rates for small spills were measured and correlated with spill volume, oil density and water viscosity. Field data and energy conservation, however, indicates that these aspects of small spills cannot be scaled up to large spill volumes. Wind-water basin tests indicated that on quiet open water oil should drift windward at 3.66 plus or minus .17% of the wind velocity. The percentage drift was not significantly affected by oil or water properties, depth, and wind speed, and agrees fairly well with field data. Waves caused significant reductions in wind drift, but in the shallow basin used did not induce significant drift themselves. Since wind causes waves, and deep water waves cause drift, further investigation of wind and wave drift interaction is recommended. Wind drift was found to be confined to a thin surface layer. The use of 1 - 1 1/2 inch deep oil-confining drogues markedly reduced wind drift. Investigation of the use nets of such drogues and of lens formation to reduce oil spread and movement is recommended. In all cases combined wind and current drifts were found to be less than the current drift in the absense of winds.
W70-08163

A METHOD FOR PREDICTING POLLUTANT TRANSPORT IN TIDAL WATERS,
California Univ., Berkeley. Hydraulic Lab.
Hugo B. Fisher.

California Water Resources Center Contribution No. 132, March, 1970. 143 p, 9 tab, 14 fig, 21 ref. Project W-165.

Descriptors: Tidal waters, *Estuaries, Numerical models, Model studies, Path of pollutants, *Water pollution sources, Estuarine environment, Water pollution effects, *Forecasting, Computer programs, Dispersion.
Identifiers: *Tidal hydraulics, Tidal velocity, Tidal elevation, Pollutant transport, Pollutant dispersion, Estuarine geometry.

A numerical model is presented in two parts; part one models the tidal hydraulics of an estuary and determines tidal velocities and elevations; part two models the transport and dispersion of pollutants. The only input required to the model is the tidal fluctuation of water surface at the estuary mouth and the geometry and frictional characteristics of the estuary. The model may be used to predict pollutant distributions from discharges in existing estuaries, or to determine effects on pollution caused by changing the estuarine geometry. The model is entirely predictive, it models both the hydraulics and pollutant transport without requiring field measurement of artificial coefficients. The model is intended as a tool in pollution studies; it can be used to study in advance of construction the effect of dredging, dike-building, or channel realignment, or the effect on an existing estuary of a new source of pollutant. It is hoped that the model will be found useful in the continuing effort to improve our environment.
W70-08168

THE PRACTICE OF WATER POLLUTION BIOLOGY,
Federal Water Pollution Control Administration, Washington, D.C. Div. of Technical Support.
For primary bibliographic entry see Field 05A.
W70-08197

WATER QUALITY EFFECTS OF LEACHING FROM SUBMERGED SOILS,
National Field Investigations Center, Cincinnati, Ohio.
Lowell E. Keup, Gerald D. McKee, Edward W. Raabe, and Richard W. Warner.
Journal of American Water Works Association, Vol 62, No 6, p 391-396, June 1970. 6 p, 6 fig, 2 tab.

Descriptors: *Leaching, *Organic soils, *Water quality control, *Reservoirs, *Reservoir design, Humus, Organic matter, Iron, Manganese, Water quality, Water chemistry.
Identifiers: Cape Fear River (NC).

Impounding water may result in the leaching of undesirable materials from the inundated soils. The Northeast Cape Fear River to be impounded in Kornegay Reservoir contained high color values (100+units), high concentrations of lignin (13.6 mg/l), and concentrations of nitrogen and manganese that might interfere with water uses. This water could leach additional quantities of lignin, iron, manganese, and total phosphorus from the leaf litter covering the reservoir site. Experiments indicated that iron and manganese were leached at a greater rate under anaerobic conditions. With clear waters, (color, 18 units), substantial increases in materials leached were observed in either aerobic or anaerobic waters. The one exception was manganese which decreased substantially in the aerobic waters. It is recommended that organic-rich materials, especially leaf litter, be removed or plowed into the soil to prevent leaching of excessive iron, manganese, and lignin to the water. If practical, organic rich soils such as muck should be removed or buried. In addition, provisions should be made for multi-level water supply intakes. (Knapp-USGS)
W70-08218

EVALUATION OF POTENTIAL ACID MINE DRAINAGE,
Carnegie-Mellon University, Pittsburgh, Pa.
For primary bibliographic entry see Field 05G.
W70-08234

CLASSIFICATION OF ORGANIC POLLUTION IN SURFACE WATERS,
Research Inst. for Industrial Water Treatment, Prague (Czechoslovakia).
For primary bibliographic entry see Field 05A.
W70-08236

CURRENT WATER QUALITY CONDITIONS AND INVESTIGATIONS IN THE UPPER POTOMAC RIVER TIDAL SYSTEM,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
Johan A. Aalto, Norbert A. Jaworski, and Donald W. Lear, Jr.
Federal Water Quality Administration, Chesapeake Technical Support Laboratory Technical Report No 41, May 1970. 38 p, 4 fig, 6 tab, 17 ref.

Descriptors: *Estuaries, *Water pollution effects, *District of Columbia, Tidal effects, Nutrients, Eutrophication, Water quality, Water pollution control, Surveys, Investigations, Path of pollutants, Sampling, Water analysis, Algae, Coliforms, Dissolved oxygen.
Identifiers: *Potomac River.

Based on data obtained by field investigations and from waste water treatment agencies in the Washington metropolitan area, a statement on current water conditions and investigations of the upper Potomac River tidal system was prepared and summarized. Fecal coliform densities are lower than in 1965 as a result of the increased chlorination of treated waste discharges since 1969. High fecal coliform densities were prevalent at times of high stream flow above the major wastewater discharges. These high densities can be attributed to a combination of land runoff from the upper Potomac basin, urban runoff, storm sewers and combined sewer overflows. Tributaries also contained very high fecal coliform densities at times. Extensive phytoplankton blooms were detected. Since the late 1930's the amount of phosphorus entering the Potomac has increased about tenfold and nitrogen increased about fivefold. The major shift toward nuisance blue-green algal growths appears to be related to increases in nitrogen and phosphorus, and not BOD (carbon). Most of the phosphorus which entered the tidal system from the upper basin, plus some from local waste water discharges, was adsorbed and deposited in the bottom sediments of the estuary. Dye and mathematical model investigations indicate that waste water assimilation and transport rates are very low. (Knapp-USGS)
W70-08248

PRELIMINARY ANALYSES OF THE WASTE WATER AND ASSIMILATION CAPACITIES OF THE ANACOSTIA TIDAL RIVER SYSTEM,
Federal Water Quality Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05A.
W70-08249

A LAGRANGIAN METHOD FOR PREDICTING POLLUTANT DISPERSION IN BOLINAS LAGOON, CALIFORNIA,
Geological Survey, Menlo Park, Calif.
Hugo B. Fischer.
U S Geological Survey Open-file report, December 31, 1969. 79 p, 12 fig, 1 tab, 13 ref, append.

Descriptors: *Dispersion, *Path of pollutants, *Bays, *Tidal effects, *California, Computer programs, Mathematical models, Water pollution control, Tides, Currents (Water), Tracers, Dye releases, Lagoons, Inlets (Waterways).
Identifiers: Bolinas Lagoon (Calif).

A numerical method and computer program are presented for use in predicting the movement and dispersion of a pollutant in a tidal embayment. The embayment geometry and the tidal cycle of water surface elevations at various interior points must be known. The computer program will generate the motion and dispersion of a concentrated slug of pollutant, or it will predict the concentration of pollutant at all points within the embayment resulting from a constant discharge at one point. The method was verified by predicting the dispersion of a slug of pollutant discharged near the mouth of Bolinas Lagoon, California. In field experiment, a slug of Rhodamine WT dye tracer dispersed in reasonable conformity to the numerical prediction. The numerical method was also used to predict the concentration distribution in Bolinas Lagoon resulting from a continuous addition of a pollutant at the location of the existing sewage outfall. A study was also made of the benefit resulting from detention of the pollutant during a two-hour period at low tide. In this case asignificant concentration reduction is observed in those portions of the lagoon which were previously the most seriously polluted. (Knapp-USGS)
W70-08254

EXPERIMENTAL DETERMINATION OF MAXIMUM PERMISSIBLE FERROCYANIDES (POTASSIUM FERROCYANIDE) CONCENTRATION IN NATURAL BODIES OF WATER,
R. D. Smirnova, S. M. Pavlenko, and Ye. M. Oleynik.
Translated from Russian: Available from the Clearinghouse in PB-185 824T, p 110-115, $3.00 in paper copy, $0.65 in microfiche. Included In: USSR Literature on Water Supply and Pollution Control, CFSTI, Vol 10, 1969, p 110-115.

Descriptors: *Water pollution, *Pollutants, *Analytical techniques, Methodology, Organoleptic properties, Organic compounds, Toxicity, Odor, Color, Taste, Biochemical oxygen demand.
Identifiers: *Ferrocyanide.

The maximum permissible potassium concentration ferrocyanide was established for potable water. Scattered and solar light, temperature of environment, reactions in the water and mixing factor were given special attention. The organoleptic threshold concentration of potassium ferrocyanide is 2.5 mg/l, the threshold concentration for the general sanitary regime is 25 mg/l, and the toxicological dose is 1.25 mg/l. Maximum permissible concentration for potassium ferrocyanide should be established on the basis of the sanitary-toxicological index. (Carstea-USGS)
W70-08288

SANITARY PROTECTION OF WATER BODIES AGAINST POLLUTION BY INDUSTRIAL WASTE WATERS: INDUSTRIAL POLLUTANTS OF WATER BODIES,
S. N. Cherkinskiy.
Translated from Russian. Available from the Clearinghouse in PB-185 824T, p 187-193, $3.00 in paper copy, $0.65 in microfiche. Included In: USSR Literature on Water Supply and Pollution Control, CFSTI, Vol. 10, 1969, p 187-193.

Descriptors: *Water pollution sources, *Pollutant identification, Water pollution, *Water pollution control, *Industrial wastes, Pollutants, Chemical wastes, Methodology, Analytical techniques, Water resources.

A collection of translations from USSR literature published under the title 'Industrial Pollutants of Water Bodies' contains 25 studies on the biological effects and hygienic significance of specific chemical industry pollutants. Several papers deal with scientific methodology and criteria used in experimental work for establishing maximum levels of harmful pollutants. This collection is addressed to public health physicians, hygienists, engineers, and technical personnel engaged in protecting water resources against pollution. (Carstea-USGS)
W70-08292

INVESTIGATIONS OF THE SUPPLY OF NUTRIENTS PROVIDED BY A PREDOMINANTLY AGRICULTURALLY UTILIZED WATERSHED WITH LAND SETTLEMENT (IN GERMAN),
H. Bernhardt, W. Such, and A. Wilhelms.
Munchner Beitrage zur Abwasser-, Fischerei- und Flussbiologie, 1969. Vol 16, p 59-118. 38 fig, 30 tab, 34 ref.

Descriptors: *Eutrophication, *Reservoirs, *Water pollution sources, Tributaries, Precipitation (Atmospheric), Runoff, Nitrogen, Phosphorus, Effluents, Domestic wastes, Agricultural watersheds, Farm wastes.
Identifiers: Wahnbach Reservoir (West Germany).

This voluminous report incorporates many previous findings of the senior author pertinent to the Wahnbach Reservoir, its hydrological and eutrophication features. In this paper primary attention is given to the two major factors of chemical pollution--nitrogen and phosphorus. The investigation disclosed that the larger part of nutrients, especially phosphorus, enriching the Wahnbach Reservoir, originates in agriculturally utilized areas, particularly numerous piles of animal manure. Only 40% of the annual quantity of phosphorus could be diverted from the reservoir by a combination of mechanical, biological, and chemical treatments. In the authors' opinion, the last statement is of decisive importance in planning the restoration measures for the area in question. (Wilde-Wisconsin)
W70-08356

THERMAL GRADIENTS IN RIVERS AND RESERVOIRS DUE TO HEATED PLANT EFFLUENTS,
Mississippi State Univ., State College. Water Resources Research Inst.
Adnan Shindala, and Melville S. Priest.
Available from the Clearinghouse as PB-193 022, $3.00 in paper copy, $0.65 in microfiche. Completion Report, June 1970. 20 p, 9 fig, 5 ref. OWRR Project A-037-MISS (1).

Descriptors: *Thermal pollution, *Heated effluents, Hydraulics, Rivers, Reservoirs, Thermal stratification, Estuaries, *Path of pollutants, Water pollution sources.
Identifiers: *Thermal gradients, *Calefaction, Cooling ponds.

The direction of heated effluents from large thermal power plants into stream and lakes has been a matter of public concern for some time, and the collection of prototype data related to the hydraulic aspects has taken on massive proportions. Unfortunately, most of the data are proprietary and not available for public analysis. The authors have endeavored to collect such data as are available to them for the initiation of steps toward generalization and the discussion of some of the more evident hydraulic considerations. The study is primarily concerned with rivers, including estuaries, with some interest in cooling ponds.
W70-08423

INFLUENCE OF LOG HANDLING PRACTICES ON WATER QUALITY,
Oregon State Univ., Corvallis. Dept. of Civil Engineering
For primary bibliographic entry see Field 05C.
W70-08476

RADIONUCLIDE ACCUMULATION IN COLUMBIA RIVER BIOTA,
Oregon State Univ., Corvallis. Environmental Health Sciences Center
Donald R. Buhler
In: Water Studies in Oregon, Oregon State University, Water Resources Research Institute Fall Quarter 1969 Seminar WR012.69, Corvallis, p 41-54, January 1970. 14 p, 5 fig, 2 tab, 7 ref.

Descriptors: *Radioactive wastes, *Radioisotopes, *Columbia River, *Washington, *Nuclear powerplants, Path of pollutants, Water pollution effects, Fish, Safety, Toxicity, Public health, Standards, Waste disposal, Radioactive waste disposal.
Identifiers: Hanford (Wash).

The radionuclides released into the aquatic environment daily by the nuclear reactors at Hanford, Wash, were studied and found do not present a serious hazard to aquatic or terrestrial life living in or along the Columbia River. Maximum permissible levels of radioactivity released into the water are specified so that it is impossible for man to ingest sufficient quantities of fish or other radioactive species from the area to exceed permissible levels of radioactivity in the body. The absence of demonstrable hazardous effects on man or his environment during the 25 years of continuous safe release of radioactive wastes from the nuclear reactors at Hanford should provide some basis for an evaluation of the impact of a modern nuclear power plant which releases less than 0.02 percent as much radioactivity to the aquatic environment. (See also W70-08475). (Knapp-USGS)
W70-08478

WATERBORNE STYRENE IN A CRYSTALLINE BEDROCK AQUIFER IN THE GALES FERRY AREA, LEDYARD, SOUTHEASTERN CONNECTICUT,
Geological Survey, Hartford, Conn.
I. G. Grossman.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B203-B209. 7 p, 3 fig, 1 tab, 12 ref.

Descriptors: *Path of pollutants, *Groundwater movement, *Aquifers, *Connecticut, *Organic wastes, Joints (Geology), Fractures (Geology), Water pollution sources.
Identfers: *Styrene.

Styrene, a synthetic hydrocarbon which is only slightly soluble in water, was readily waterborne in the Gales Ferry area, Connecticut in 1961-64. Following shallow burial in 1960, styrene moved downward with vadose water through thin glacial till into the bedrock aquifer, which consists in large part of schist and quartzite and in small part of granite gneiss. Movement from two contaminating sources to cones of depression at six domestic wells was principally westward and northward along foliation joints and cross joints. Maximum overall movement exceeded 300 feet. Removal of the sources of contamination produced water of satisfactory chemical quality in 2 years or less. (Knapp-USGS)
W70-08489

DOSAGE REQUIREMENTS FOR SLUG INJECTIONS OF RHODAMINE BA AND WT DYES,
Geological Survey, Washington, D.C.
F. A. Kilpatrick.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B250-B253, 1970. 4 p, 3 fig, 2 ref.

Descriptors: *Tracers, *Dye releases, *Tracking techniques, Path of pollutants, Dispersion, Mixing, Streamflow, Discharge (Water), Stream gages.
Identifiers: Dye dosage.

Time-of-travel measurements, simulation studies of waste and thermal pollution, dispersion tests, and dilution type discharge measurements, in streams and estuaries, involve the slug injection of specific amounts of fluorescent dyes. Curves relating quantities of dye required for slug injections into streams are developed from data from nearly 500 field time-of-travel tests. Separate relationships are developed for Rhodamine BA and Rhodamine WT dyes. The application of the relationships is illustrated by an example.
W70-08498

THE MAGNITUDE AND EXTENT OF SALT-WATER CONTAMINATION IN THE CALOOSAHATCHEE RIVER BETWEEN LA BELLE AND OLGA, FLORIDA,
Geological Survey, Tallahassee, Fla.
Durward H. Boggess.
Florida Bureau of Geology Information Circular No 62, Part 2, p 17-39, 1970. 23 p, 8 fig, 2 tab, 3 ref.

Descriptors: *Saline water intrusion, *Canals, *Locks, *Streamflow, *Florida, Mixing, Density currents, Water pollution sources, Sea water, Chlorides, Path of pollutants.
Identifiers: Caloosahatchee River (Fla).

Repeated injections of salt water through the lock chamber at the W. P. Franklin Dam causes a progressive increase in the chloride content of water in the fresh water reach of the Caloosahatchee River during low-flow periods. Vertical profiles in the contaminated reach of the river show essentially the same chloride content of the water from the surface to a depth of about 12 feet and consistently higher concentrations at greater depths. The chloride content of the water in the deep and shallow zones decreases with increased distance upstream from the dam. In the deeper parts of the river channel, the upstream limit of water containing 250 mg/l of chlorides was 11.4 miles from the dam in May 1968. At shallow depths, the upstream limit of water containing 250 mg/l of chlorides was 5.3 miles from the dam in May 1967 and 4.7 miles from the dam in April 1968. (See also W70-08516). (Knapp-USGS)
W70-08517

MERCURY CONTAMINATION IN THE NATURAL ENVIRONMENT,
Bureau of Commercial Fisheries, Ann Arbor, Mich.; and Dept. of Interior, Washington, D.C. Office of Library Services.
For primary bibliographic entry see Field 05A.
W70-08541

5C. Effects of Pollution

SENSITIVITY OF BENTHIC MICROFLORA TO POLLUTION GRADIENTS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
Nelson Marshall, Donald M. Skauen, and Candace A. Oviatt.
Available from the Clearinghouse as PB-192 853, $3.00 in paper copy, $0.65 in microfiche. Final Project Report (1970). 70 p, 9 ref. FWQA Project 18050DXU--6/70, Grant 1WP-01220.

Descriptors: Benthic flora, *Microorganisms, *Water pollution effects, Estuarine environment, *Productivity, Sedimentation, Environmental effects, Pollutants identification.
Identifiers: *Benthic microflora, Pollution gradients.

This program was initiated in June 1967 to evaluate relationships between the productive condition of the sediment environment and pollution effects normally experienced along a densely populated coastline. Specifically the work was designed to: (a) improve the methodology for measuring the productivity of the benthic microflora community; (b) determine the normal rate of productivity of the microflora community of shoal benthic environments, as indicated by the rate of 14C uptake by intact samples of samples; and (c) compare this norm with productivity in an area affected by heavy domestic pollution and an area affected by thermal addition. (Limited results were obtained for this objective.) Data are presented on the reliability

nd variability of calculations of primary produc-
vity.
V70-08164

'LANKTON COMMUNITY AND HYDRAULIC 'HARACTERIZATION PRELIMINARY TO .AKE FLUSHING,
Vashington Univ., Seattle. Dept. of Civil Engineer-
ng.
ugene B. Welch, Ronald J. Buchanan, Ronald E.
lece, and Richard H. Bogan.
Available from the Clearinghouse as PB-192 760, 3.00 in paper copy, $0.65 in microfiche. Final re-
ort, October, 1969. 181 p, 11 tab, 32 fig, 14 ref, 3
ppend. FWQA Project 16010--10/9.

Descriptors: Eutrophication, *Plankton, Lakes, tanding crop, *Nutrients, Water quality, Water ollution effects, *Hydraulic models, Mathemati-al models, Water pollution control, Washington.
dentifiers: *Moses Lake (Washington), *Lake lushing, Flushing, Low-nutrient water.

The effect was evaluated of adding varying mounts of low-nutrient flushing water to one area f Moses Lake, a 6,500-acre highly eutrophic lake n eastern Washington. Cluster analysis of plankton lata identified 6 sample groups and species groups. Temporal and spatial variations in community ypes and standing crops appear to be related to de-ention time, nitrate content, and available light. The effect of low-nutrient dilution water on lake lankton growth response indicated growth at 90% nd 86% lake water. General agreement was ob-ained among 3 field techniques for determining ime of travel through a section of upper Parker Horn. Dye studies, diurnal plankton sampling, and ield observations indicate that southerly winds ave a great effect on moving algae upstream into pper Parker Horn. Water movements in the lake ould be simulated in a distorted Froude law ydraulic model. Removal of algae and nutrients by lushing procedures in Parker Horn and the lower ake would likely be more effective at night. Moses Lake behaves both biologically and hydraulically as though it were divided into several partially iso-ated regions. A tentative mathematical model has been set up for simulating the productivity and dis-tribution of algae. Flushing Parker Horn with large slugs of low nutrient water may not be effective because of wind action transporting algae and their entrained nutrients back into the Horn together with nutrient regeneration from sediments.
W70-08166

THE PRACTICE OF WATER POLLUTION BIOLOGY,
Federal Water Pollution Control Administration, Washington, D.C. Div. of Technical Support.
For primary bibliographic entry see Field 05A.
W70-08197

WATER QUALITY BEHAVIOR IN RESERVOIRS,
Consumer Protection and Environmental Health Service, Cincinnati, Ohio.
James M. Symons.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $3.25. US Public Health Service Publication No 1930 (Compilation of Research Papers), Department of Health, Education, and Welfare, Cincinnati, Ohio, 1969. 616 p. Published by US Government Printing Office, Wash, DC.

Descriptors: *Water quality, *Reservoirs, *Eutrophication, *Limnology, Dissolved oxygen, Oxygen demand, Aeration, Mixing, Water pollution, Biological properties, Nutrients, Research and development, Organic wastes, Stratification.
Identifiers: Water storage effects.

The technical papers prepared from data collected for the project 'Influence of Impoundments and Controlled Releases on Water Quality.' from September 1962 through December 1966 are compiled. Research on this project was divided into two broad categories: (1) investigative research, designed to better understand reservoir water quality behavior; and (2) engineering research, designed to develop engineering methods for the control of reservoir water quality. Papers included in this Compilation cover a review of the literature on the project topic and a statement of research needs, and research on the dissolved oxygen budget in reservoirs, on the behavior of the nitrogen cycle in reservoirs, on the behavior of synthetic organics in stratified reservoirs, and on the use of artificial destratification as an engineering technique for managing and maintaining good quality water in reservoirs. A bibliography was compiled of papers relating to artificial destratification. (Knapp-USGS)
W70-08278

INCREASING THE RELIABILITY OF EXPERIMENTAL RESULTS ARRIVED AT IN STUDIES ESTABLISHING HYGIENIC STANDARDS FOR HARMFUL SUBSTANCES IN BODIES OF WATER,
For primary bibliographic entry see Field 05A.
W70-08285

DEPENDENCE OF THE EMBRYONIC DEVELOPMENT AND VIABILITY OF THE CARP ON THE TRACE ELEMENT ZINC,
Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii.
V. I. Vladimirov.
Voprosy Ikhtiologii (Problems of Ichthyology) Vol 9, No 5, 1969, p 687-696. 27 ref. 3 fig, 4 tab.

Descriptors: Water pollution effects, *Carp, *Embryonic growth stage, *Viability, Heavy metals, Fish eggs, Fish physiology, Larval growth stage, Toxicity, Trace elements, Laboratory tests, Fertility.
Identifiers: Zinc, Embryonic development, *Zinc sulfate, Survival.

Zinc concentrated in very large amounts by carp eggs in the course of oogenesis has an adverse effect on embryonic development and on the viability of the larvae. The addition of zinc sulfate in amounts of 0.05 mg/liter in the early stages of embryogenesis improved the development and viability of the larvae on average. The same effect was also noted when larvae were exposed to the stated doses in the first 10-15 days after hatching, but the positive effect was weaker in this case. The reactions of embryos and larvae to the addition of zinc are largely dependent on zinc content in the eggs. (Sjolseth-Washington)
W70-08360

HEAT TOLERANCE OF CHANNEL CATFISH, ICTALURUS PUNCTATUS,
Arkansas Univ., Fayetteville. Dept. of Zoology.
Kenneth O. Allen, and Kirk Strawn.
Proceedings, 21st Annual Conference of the Southeastern Association of Game and Fish Commissioners, 1967, p 399-411. 4 figs, 2 tab. 15 refs.

Descriptors: Catfishes, Channel catfish, Acclimatization, *Heat resistance, Heated water, Thermal pollution, Thermal stress, Resistance, Lethal limit, Water pollution effects, Mortality, Fishkill, Fish physiology, Effects.
Identifiers: *Ictalurus punctatus, *Thermal tolerance, Survival, *Lethal effects.

Three lots of channel catfish, comprising tow size and age groups were tested for several factors affecting heat tolerance. Heat tolerance was apparently determined by genetic background, acclimation level, and to a lesser extent by age. Thermal history prior to acclimation and size did not appear to influence heat tolerance. The fingerling fish had the highest upper-lethal temperatures. However, at 'quickly lethal' temperatures older fish ahd greater resistance. The upper lethal temperatures for 44-57-day-old fish were approximately 36.6, 37.3, and 37.8 for 26.0, 30.0, and 34.0 acclimations. There appeared to be at least six lethal effects that tended to separate the fish into physiological populations on the basis of their heat resistance. Heat death may occur up to 13-3/4 days after initial exposure. High temperatures may indirectly cause mortalities over a still longer period of time by increasing the rate of metabolism beyond the fishes ability to consume food. (Sjolseth-Washington)
W70-08362

RESIDUES IN FISH, WILDLIFE, AND ESTUARIES - CHLORINATED HYDROCARBON PESTICIDES IN CALIFORNIA BAYS AND ESTUARIES,
California State Dept. of Fish and Game, Menlo Park, Calif. Marine Resources Operations.
For primary bibliographic entry see Field 05A.
W70-08363

FIELD TRIALS OF ANTIMYCIN AS A SELECTIVE TOXICANT IN CHANNEL CATFISH PONDS,
Bureau of Sport Fisheries and Wildlife, Warm Springs, Ga. Southeastern Fish Control Lab.
Ralph M. Burress, and Charles Luhning.
Investigations in Fish Control, No. 25, 1969. 11 p, 8 tab, 4 ref.

Descriptors: *Antimycin A, *Channel catfish, Fish control agents, Fish farming, Fish harvest, Fish management, Sunfishes, Shiners, Cost-benefit analysis, Commercial fish, Degradation, Fishkill, *Evaluation, Pesticides.
Identifiers: *Antimycin, Scalefishes, *Selective toxicant.

Antimycin effectively and economically controlled heavy infestations of green sunfish and golden shiners from channel catfish ponds at a Mississippi fish farm. An initial application of 5 p.p.b. of antimycin in two ponds and 7.5 p.p.b. in the third pond eliminated nearly 99 percent of the scalefishes. A followup treatment of 10 p.p.b., 4 days later, further reduced these populations with no apparent effect on yearling catfish. At harvest, three untreated ponds produced 1,474 pounds of scalefishes or an average of 389 pounds per acre, yielded 27.4 percent or 1,155 fewer catfish than the three treated ponds, and contained 1,183 undersize fish or nearly three times as many that were too small for table use. Treated ponds produced an additional 1,015 pounds of fish worth $507.50, while antimycin cost only $145.79. (See also W70-08365) (Sjolseth-Washington)
W70-08364

LABORATORY STUDIES ON ANTIMYCIN A AS A FISH TOXICANT,
Bureau of Sport Fisheries and Wildlife, LaCrosse, Wis. Fish Control Lab.
Bernard L. Berger, Robert E. Lennon, and James W. Hogan.
Investigation in Fish Control, No. 26, 1969. 20 p, 17 tab, 1 fig, 17 ref.

Descriptors: *Antimycin A, *Bioassay, Water temperature, Hydrogen ion concentration, Laboratory tests, Fish control agents, Fish management, Fish kill, *Toxicity, Mortality, *Freshwater fish, Channel catfish, Rainbow trout, Resistance, *Piscicides, Turbidity, Lethal limit.
Identifiers: *Water quality effects, Fish toxicant, *Selective toxicant, Sensitivity, Detoxification.

Liquid and sand formulations of antimycin A were tested in laboratory waters of various temperature, hardness, pH, and turbidity against 31 species of freshwater fish of various sizes and life stages. Each formulation of toxicant was lethal under all water conditions to fish eggs, fry, fingerlings, and adult fish. Trouts are the most sensitive and catfishes the least sensitive. Of the 31 species, 24 succumb to 5 p.p.b. or less of the toxicant; only certain catfishes survive 25 p.p.b. The order of toxicity to various species of fish suggests that antimycin has possibilities for selective or partial control of certain un-

wanted fish. Antimycin is more active in warm water than in cold. It is slightly more active in soft water than in hard; it is more active and persists far longer in water at pH 5 to 8 than at/pH 9 or 10. The results contributed to registration of antimycin A in Fintrol-5 formulation as a fish toxicant. (See also W70-08366) (Sjolseth-Washington)
W70-08365

FIELD TRIALS OF ANTIMYCIN A AS A FISH TOXICANT,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Philip A. Gilderhus, Bernard L. Berger, and Robert E. Lennon.
Investigations in Fish Control, No. 27, 1969. 20 p, 18 ref, 16 tab.

Descriptors: *Antimycin A, *Piscicides, *On-site tests, Degradation, Fish control agents, Hydrogen ion concentration, Resistance, Water temperature, *Fish management, Fishkill, Evaluation, Toxicity.
Identifiers: Water quality effects, *Fish toxicant, Detoxification, *Selective toxicant.

Antimycin A was subjected to field trials as a fish toxicant in 20 ponds and lakes and 5 streams in the East, Midwest, and West of the United States. Ten parts per billion or less of the toxicant were effective against most of the 54 species of fish we encountered, including carp, suckers, and green sunfish. Differences in sensitivity among fish suggest possible use of antimycin as a selective toxicant. The efficacy of the toxicant is influenced by pH and water temperature, with slightly higher concentrations necessary at high pH or in cold water. Antimycin does not repel fish, and its toxic action on fish appears to be irreversible. It degrades rapidly, usually within a week. Fishkilling concentrations have little or no effect on other aquatic animals. (See also W70-08367). (Sjolseth-Washington)
W70-08366

USE OF ANTIMYCIN FOR SELECTIVE THINNING OF SUNFISH POPULATIONS IN PONDS,
Bureau of Sport Fisheries and Wildlife, Warm Springs, Ga. Southeastern Fish Control Lab.
Ralph M. Burress, and Charles W. Luhning.
Investigations in Fish Control, No 28, 1969. 9 p, 3 tab, 5 ref.

Descriptors: *Antimycin A, *Piscicides, *Sunfishes, Georgia, *Fish control agents, Cost analysis, Fish management, Fish kill, Toxicity, Fish conservation, Water temperature, Fish populations, On-site tests.
Identifiers: *Antimycin, Fish toxicant, Selective toxicant, Selective thinning, Effective concentration, Bluegills.

Selective removal of bluegills, redear sunfish, and redbreast sunfish was accomplished in six soft-water ponds in west central Georgia by applications of 0.4, 0.6, 0.8, and 1.0 parts per billion (p.p.b.) of antimycin in the Fintrol-5 formulation. Successful treatments were made during winter, spring, and late summer at water temperatures raning from 46 deg to 75 deg F. and under a wide variety of weather conditions. The 0.4-p.p.b. treatment made at 75 deg F. removed 2.9 pounds per acre of largemouth bass less than 6 inches long and 69 pounds per acre of all sizes of sunfishes. The 0.6 p.p.b. applied at 47 deg F. reduced the numbers of bluegills less than 4 inches in length by about half with very little effect on largemouth bass or larger bluegills. Bass, bluegills, and redear sunfish which survived multiple exposures to antimycin in concentrations up to 1.0 p.p.b. were able to reproduce normally. (See also W70-08364) (Sjolseth-Washington)
W70-08367

THE SUCCESSION OF THE BOTTOM FAUNA COMMUNITIES IN POLLUTED ESTUARINE HABITATS, (PRELIMINARY REPORT),
Institute of Marine Research, Helsinki (Finland) Biology Div.
Pauli Bagge.
Limnologica, Vol. 7, No. 1, 1969, p. 87-94. 2 tab, 5 fig, 7 ref.

Descriptors: *Succession, *Benthic fauna, *Biological communities, *Water pollution effects, Estuarine environment, Salinity, Dissolved oxygen, Oligochaetes, Environmental effects, Distribution patterns, Dominant organisms, Climatic climax.
Identifiers: Sweden, *Polluted estuaries, Baltic-Skagerak region, *Salinity zones chironomids, Capitellids, Spionids, Secondary succession, *Climax communities.

The benethic faunae of five polluted estuaries situated in the Baltic-Skagerak region have been compared. The localities represent a gradation from oligohaline to mixoeuhline conditions. In all of the salinity zones compared, wherever the oxygen content of the bottom water is low limivorous or selective deposit feeding species predominate in the type species groups. In the oligohaline and /3-mesohaline zones such species are mainly oligochaetes and chironomids, while in a more saline environment these are replaced by capitellids and spionids. The secondary succession of the benthic animal communities caused by pollution was shown to be a rapid process, especially in localities where the exchange of water is limited. (Sjolseth-Washington)
W70-08368

DISTRIBUTION OF MERCURY IN WATER, BOTTOM MUD AND AQUATIC ORGANISMS OF MINAMATA BAY, THE RIVER AGANO AND OTHER WATER BODIES IN JAPAN,
Freshwater Fisheries Research Lab., Tokyo (Japan).
For primary bibliographic entry see Field 05A.
W70-08369

THE EFFECTS OF SULFIDE PULP WASTES ON THE GROWTH OF MARINE PHYTOPLANKTON,
Kagawa Univ., Takamatsu (Japan). Faculty of Agriculture.
Tomotoshi Okaichi, and Akitaka Yaguy.
Bulletin of Plankton Society of Japan, Vol 16, No. 2, p 126-132, Dec. 1969. 2 tab, 3 fig, 7 ref.

Descriptors: *Pulp wastes, Water pollution effects, *Growth rates, Chemical oxygen demand, Chemical wastes, Waste identification, Sulfite liquors, Chemical analysis, Phytoplankton, Chlorella, Lignins, Nutrient requirements.
Identifiers: *Enterptiella, Cyclotella, Lignosulfonic acid, *Prorocentrum triestinum, *Sulfide pulp liquors.

The authors described the culture of marine phytoplankton with sulfide pulp wastes diluted with either sea water or artificial media. They found that sulfide pulp wastes diluted 250 to 500 times were effective in promoting the growth of Euterptiella sp. and Prorocentrum triestinum. The pulp wastes were fractionated with ion exchange resins in order to obtain the active substances. (Sjolseth-Washington)
W70-08371

GLENODININE, AN ICHTHYOTOXIC SUBSTANCE PRODUCED BY A DINOFLAGELLATE, PERIDINIUM POLONICUM (In Japanese),
Tokyo Univ. (Japan). Lab. of Marine Biochemistry.
Yoshiro Hashimoto, Tomotoshi Okaichi, Le Dung Dang, and Tamao Noguchi.
Bulletin of the Japanese Society of Scientific Fisheries, Vol 34, No. 6, 1968. p. 528-534, 7 figs, 1 tab, 8 refs.

Descriptors: Water pollution sources, Water pollution effects, Dinoflagellates, Fishkill, Fish toxins, Bioassay, Aquatic algae, *Algal toxins, Killifishes, *Toxicity, Isolation.
Identifiers: Lake Sagami, Japan, *Glenodinine, *Peridinium polonicum, Plankton blooms.

In September 1962, extensive water blooms of a dinoflagellate identified as Peridinium polonicum, accompanied by mass mortality of fish, occurred in Lake Sagami near Tokyo. An attempt was made to isolate the suspected ichthyotoxic substance from the plankton collected from the lake. The substance was confirmed to be an alkaloid and to contain a sulfhydryl radical. The authors designated it as glenodinine. Bioassays showed glenodinine to be extremely toxic to both freshwater and marine fishes. (Sjolseth-Washington)
W70-08372

FISH POPULATIONS AND AQUATIC CONDITIONS IN POLLUTED WATERS IN LOUISIANA,
Louisiana Wild Life and Fisheries Commission.
James T. Davis.
Louisiana Wild Life and Fisheries Commission (Fisheries Section), (Bulletin 1-1960) 1960, 121 p, 68 tab, 21 figs. Dingell-Johnson Project F-4-R.

Descriptors: Fish populations, Aquatic environment, *Water pollution effects, Pulp wastes, Louisiana, *On-site investigations, *Water analysis, Water chemistry, Water quality, Domestic wastes, Fish food organisms, *Benthos, Fish reproduction, Fish migration, Comparative productivity, Bioassay, Taste, On-site data collections.
Identifiers: Ouachita River, Louisiana.

The Ouachita River in Louisiana was studied for fish populations and aquatic conditions in its polluted waters to devise a system of surveying polluted areas so that data needed to establish a workable effluent discharge compatable with fish management could be maintained. Fish populations, benthic organisms, fish stomach samples, reproduction, bioassays of selected effluents, and flesh taste tests were examined and evaluated to determine the effects of pollution on fish. (Sjolseth-Washington)
W70-08373

ORGANOCHLORINE PESTICIDES IN THE ENVIRONMENT,
Bureau of Sport Fisheries and Wildlife, Laurel, Md. Patuxent Wildlife Research Center.
Lucille F. Stickel.
For sale by the Superintendent of Documents, U.S. Gov't. Printing Office, Washington, DC, 20402--Price: $0.40. U.S. Bureau of Sport Fisheries and Wildlife; Special Scientific Report-Wildlife No. 119, 1968. 32 p, 4 tab, 226 refs.

Descriptors: *Chlorinated hydrocarbon pesticides, *Pesticide toxicity, *Pesticide residues, Pesticide kinetics, Pesticide drift, Pesticide removal, Water pollution effects, Monitoring, Aquatic environment, Animal physiology, Animal behavior, Enzymes, Mortality, DDT, Ecosystems.
Identifiers: *Pesticide effects, *Research needs, Residue monitoring, Hormones.

Highest concentrations generally occur in carnivorous species. Thus predatory and fish-eating birds ordinarily have higher residues than do herbivores. Any segment of the ecosystem receives various amounts and kinds of pesticides at irregular intervals. The different animals absorb, detoxify, store, and excrete pesticides at different rates. Different degrees of magnification of pesticide residues by living organisms in an environment are the practical result of many interactions that are far more complex than implied by the statement of magnification up the food chain. Direct mortality of wild animals as an aftermath of recommended pesticide treatments has been recorded in the literature of numerous countries. The impact of these new components of the environment has appeared as death, reproductive impairment, disruption of species balance, and behavioral alteration, but the overall effects on the environment have not been determined. Research should be aimed at interpretation of the significance of pesticide residues to survival and reproduction, to assessment of levels of pesticides in critical environments, and to the kinetics of pesticides in in-

viduals and the ecosystem. (Sjolseth-Washing-n)
'70-08374

TUDIES ON THE METABOLISM OF PEN-ACHLOROPHENATE, A HERBICIDE, IN QUATIC ORGANISMS--I. TURNOVER OF AB-ORBED PCP IN TAPES PHILIPPINARIUM. (In apanese),
yushu Univ., Fukuoka (Japan). Faculty of griculture; and Tokyo Univ. of Fishery (Japan).
unio Kobayashi, Hiroshi Akitake, and Tetuo omiyama.
ulletin of the Japanese Society of Scientific Fishe-es, Vol 35, No. 12, 1969, p 1179-1183, 3 figs, 1 b, 8 refs.

escriptors: Carbon radioisotopes, Shellfish, Her-cides, *Absorption, Degradation, *Toxicity, ode of action, Tracers, *Animal metabolism, nalytical techniques, Distribution, Distribution atterns, Biodegradation.
entifiers: *Pentachlorophenate, *Tapes philip-narium, Bojanus organ, Liver, *Tissue analyses, istribution rate, Carbon-14.

regards to the toxicity of PCP to a shell-fish, apes philippinarum, it has previously been re-orted that the PCP levels higher than 0.1 ppm was thal. The paper deals with the turnover of ab-orbed PCP in the shell-fish using C-labelled PCP. CP dissolved in the media was rapidly absorbed y the shell-fish and distributed into the various tis-ues, especially the Bojanus' organ and the liver, nd then quickly eliminated, presumably from the ojanus' organ. It was also revealed that most of ie accumulated PCP in the tissues were undecom-osed and were either free or in the bound form. Sjolseth-Washington)
'70-08375

HERMAL POLLUTION - BIOLOGICAL EF-ECTS, A REVIEW OF THE LITERATURE OF 969,
attelle-Northwest, Richland, Wash.
harles C. Coutant.
o be published in Journal of Water Pollution Con-rol Federation, Review of Literature of 1969 on Vaste Water and Water Pollution Control, June 970. Battelle Memorial Institute, Pacific Northwest Laboratory Report SA-3255, 1970. 90 , 200 refs, 2 appendices, AEC Contract AT (45-0-1830).

Descriptors: *Reviews, *Thermal pollution, Water pollution effects, Aquatic animals, Aquatic lants, Thermal water, Bibliographies, On-site in-estigations, Biogeography, Resistance, Reproduc-on.
Identifiers: *Literature review, Synergism, Polymorphism, Temperature selection.

This paper is a review of the literature of 1969 on he biological effects of thermal pollution. Two undred articles were mentioned and these were rouped into such basic categories as site studies, iogeography, synergism, resistance, reproduction, olymorphism, growth, temperature selection, hysiology, primary production, beneficial uses, tc. Author's addresses were given to facilitate equests for reprints. (Sjolseth-Washington)
W70-08376

THE TOXIC EFFECT OF PEN-TACHLOROPHENATE, A HERBICIDE, ON FISHERY ORGANISMS IN COASTAL WATERS V. (In Japanese),
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture; and Tokyo Univ. of Fishery (Japan).
Junio Kobayashi, Takeaki Kurokawa, and Tetuo Tomiyama.
Bulletin, Japanese Society of Scientific Fisheries Vol. 35, No. 2, 1969, p 206-210. 7 figs, 8 refs.

Descriptors: Shellfish, Herbicides, *Bioassay, Tox-city, *Salinity, *Resistance, Effects, *Mortality, Seasonal.
Identifiers: *Pentachlorophenate, *Tapes philip-pinarum, *Low salinity sea water, Seasonal varia-tion.

This paper deals with the relationship between the toxic effects of PCP and/or the diluted sea water on the shell-fish. The toxic threshold of the diluted sea water to the shell-fish was in the vicinity of 7% in the chlorinity at 25 deg C. In the higher chlorinity than 7% the toxicity of PCP increased according to the increase in concentration more than 0.1 ppm. In the lower chlorinity than 7%, however, the tox-icity of PCP, even at 0.3 ppm level, was obscured under the arising toxicity of the lower salinity. The preculture in a diluted sea water of 5% chlorinity did not promote the toxicity of PCP, at 0.2 and 0.3 ppm level, to the shell-fish. The resistance of the shell-fish to a low salinity sea water or PCP changed seasonally during the experiments from July 24th to Oct 9th. Therefore, the experiment on the toxic effect of PCP to the shell-fish must be done at the same time when the shell-fish is damaged by PCP used in the fields. (Sjolseth-Washington)
W70-08377

STUDIES ON THE METABOLISM OF PEN-TACHLOROPHENATE, A HERBICIDE, IN AQUATIC ORGANISMS -III. ISOLATION AND IDENTIFICATION OF A CONJUGATED PCP YIELDED BY A SHELL-FISH, TAPES PHILIP-PINARUM (In Japanese),
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture; and Tokyo Univ. of Fishery (Japan).
For primary bibliographic entry see Field 05A.
W70-08378

STUDIES ON THE METABOLISM OF PEN-TACHLOROPHENATE, A HERBICIDE, IN AQUATIC ORGANISMS -II. BIOCHEMICAL CHANGE OF PCP IN SEA WATER BY DETOXI-CATION, MECHANISM OF TAPES PHILIP-PINARUM (In Japanese),
Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture; and Tokyo Univ. of Fishery (Japan).
For primary bibliographic entry see Field 05A.
W70-08379

TOXICITY OF YELLOW PHOSPHORUS TO HERRING (CLUPEA HARENGUS), ATLANTIC SALMON (SALMO SALAR), LOBSTER (HOMARUS AMERICANUS), AND BEACH FLEA (GAMMARUS OCEANICUS),
Fisheries Research Board of Canada, St. Andrews (New Brunswick).
V. Zitko, D. E. Aiken, S. N. Tibbo, K. W. T. Besch, and J. M. Anderson.
Journal of the Fisheries Research Board of Canada, Vol 27, p 21-29, 1970. 3 fig, 2 tab, 6 ref.

Descriptors: *Phosphorus, Atlantic salmon, Her-rings, Lobsters, *Bioassay, *Lethal limit, *Toxicity, Fishkill, Fish physiology, Oxidation, Animal physiology, Water pollution effects.
Identifiers: *Yellow phosphorus, Beach flea, Gam-marus Oceanicus, Hemolysis.

Yellow phosphorus is extremely toxic to aquatic life. In herring, salmon, and lobster, the toxic effect of phosphorus is irreversible and probably cumula-tive. For herring LT50 (hours) = 300/C0.87, where C = /u g/liter of phosphorus. No clear indications of an incipient lethal level were found, an LT50 being obtained even at a concentration of 2.5 /ug/liter. Incipient lethal levels of yellow phosphorus for lobster, salmon, and beach flea are 40 ug/liter, 18 ug/liter, and 304 mg/liter, respectively. Poisoned fish turn red and show signs of extensive hemolysis. Blood of lobster congeals, and after death the thorax may be filled with thick gel and the heart grossly distended. For lobster, LT50 (hours) = 300-0.17x, where x = product of phosphorus con-centration and exposure time (ug days/liter). The oxidation of dispersions of yellow phosphorus in water is kinetically a first-order reaction with hald-life of 2-7.5 hr. The absorption of yellow phosphorus on a solid support such as bottom mud substantially decreases the rate of oxidation. (Sjol-seth-Washington)
W70-08380

EFFICACY OF QUINALDINE AS AN ANESTHETIC FOR SEVEN SPECIES OF FISH,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Richard A. Schoettger, and Arnold M. Julin.
Investigations in Fish Control, No. 22, 1969, 9 p, 4 tab, 18 ref.

Descriptors: *Evaluation, Rainbow trout, Brown trout, Brook trout, Channel catfish, Bass, *Equilibrium, *Fish behavior, Fish physiology, Fish management, Toxicity, Water chemistry, Hydrogen ion concentration, Fish eggs, Laboratory tests.
Identifiers: *Quinaldine, *Anesthetic, Bluegill, Drug, Narcosis, *Efficacy.

Quinaldine was tested as an anesthetic for rainbow trout, brown trout, brook trout, lake trout, channel catfish, bluegill, and largemouth bass. In general 15 to 70 ppm of the drug induces total loss of equilibri-um in fish within two minutes. Efficacy is in-fluenced by acid pH and for some species, by tem-perature, but not by water hardness, age of quinal-dine solutions, or repeated exposures of fish to quinaldine. Assets include rapid action and pro-longed maintenance of anesthesia, but anethetized fish retain a degree of reflex responsiveness which may interfere with stripping, delicate surgical operations, and blood collection. The drug is harm-less to fertilized rainbow trout eggs at concentra-tions and exposure time normally encountered in spawning operations. (See also W70-08382). (Sjol-seth-Washington)
W70-08381

QUINALDINE AS AN ANESTHETIC FOR BROOK TROUT, LAKE TROUT, AND ATLAN-TIC SALMON,
Maine Dept. of Inland Fisheries and Game, Au-gusta.
David O. Locke.
Investigations in Fish Control, No. 24, 1969. 4 p, 1 fig, 6 refs.

Descriptors: Atlantic salmon, Brook trout, Lake trout, *Evaluation, *Resistance, Fish behavior, Fish management, Laboratory tests, Cost com-parisons, Fish physiology.
Identifiers: *Quinaldine, *Anesthetic, *Sensitivity, *Recovery, MS-222, Water temperature effects.

Quinaldine (2-methylquinoline) was an effective anesthetic for yearling Atlantic and landlocked sal-mon and book and lake trout in waters ranging from 10 to 40 ppm total hardness and temperatures ranging from 36 deg to 40 deg F. and from 47 deg to 59 deg F. Lake trout were more sensitive than the other species tested. In tests, anesthetization and recovery rates for five concentrations (5, 10, 15, 20 and 25 ppm) at both temperatures (10 ppm) was generally satisfactory for lake trout. A concen-tration of 15 ppm was satisfactory for marking and general handling of salmon and brook trout. Quin-aldine is one twenty-fourth as expensive as MS-222 at 1:12,000, and in view of the results the author feels this drug warrants wider use as a fish anesthetic. (See also W70-08381). (Sjolseth-Washington)
W70-08383

RELATIONSHIP BETWEEN SEA WATER AND BOTTOM CONDITION AND MECHANISM OF FISHERIES PRODUCTION IN ESTUARINE AREAS (In Japanese). WITH SPECIAL REFERENCE TO THE DETERIORATION OF PEARL OYSTER FARM,
Mie Prefectural Univ., Tsu (Japan). Faculty of Fisheries.
Fukuzo Uyeno.
Bulletin Japanese Society of Fisheries Oceanog-raphy, Special Number (Prof. Uda's Commemora-tive Papers), 1969. p. 193-196. 1 fig, 22 refs.

Descriptors: *Bottom sediments, Estuarine environment, Commercial shellfish, Oysters, *Deterioration, *Aquaculture, *Cycling nutrients, Hydrogen sulfide, Water quality, Water quality control, Stagnant water.
Identifiers: *Pearl oysters, *Environmental deterioration, Over-culture.

This paper deals with the deterioration of pearl oyster farms by over-culture, from a viewpoint of circulation of nutrient substances in the farm water in a rather closed area. The deterioration is environmentally observed as appearances of low oxygen water, hydrogen sulfide poisoning, anaerobic bottom mud, etc. These happen quite suddenly in July and September by the stagnation of water after a long rain and a neap tide. At this time many organic substances and inorganic nutrient salts are supplied to the water from superficial bottom mud and this consumes oxygen. Originally the organic substances are pearl oyster faeces and dead phytoplankton. Therefore, water exchange near the bottom is an important problem. It is becoming clear that there are some qualitative differences for the growth of pearl oysters among the estuarine environments, such as chlorophyll content of water, phaeophytin content of superficial bottom mud and so on. Methods to artificially recover such deteriorated farms were tried from various view points, especially by accelerating the bottom water exchange. (Sjolseth-Washington)
W70-08384

TYPICAL FISH MORTALITY RATES IN EASTERN LAKE ERIE,
State Univ. Coll., Fredonia, N.Y.
Linda A. Tomkiewicz.
Lake Erie Environmental Studies, Technical Data Report, Number 4, April 1970, 15 p, 5 fig, 9 ref.

Descriptors: *Lake Erie, *Fishkill, Mortality, Smelts, Bass, Bullheads, Great Lakes, On-site data collections, *Water pollution effects, Water pollution sources, Fish diets, Carp, Commercial fishing, Sport fishing, Fish populations, Yellow perch.
Identifiers: *Seasonal mortality variations, Alewife.

This study was conducted to establish a base line of natural fish mortalities in eastern Lake Erie throughout a yearly cycle. Seasonal variations in mortality rate indices are shown graphically for the eight most common species (smelt, black bullheads, white suckers, sheepshead, yellow perch, white bass, smallmouth bass, and rock bass). No direct cause for the mortality could be given although the author stated possible causes as predation, diseases and parasitism, pollution, and physical damage caused by man. Most causes of high fish mortality rates were related to commercial and sports fishing activity. The need for further research is stated. (Sjolseth-Washington)
W70-08385

THE EFFECTS OF SUSPENDED AND DEPOSITED SEDIMENTS ON ESTUARINE ORGANISMS; AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES,
Maryland Univ., Solomons. Natural Resources Inst.
J. Albert Sherk, Jr., and Eugene L. Cronin.
Natural Resources Institute of the University of Maryland. Reference No. 70-19, April, 1970. 62 p, 179 ref. Contract No. DACW73-70-C-0013 by U.S. Army Corps of Engineers.

Descriptors: *Bibliographies, *Water pollution effects, *Sediments, *Bottom sediments, *Suspended load, *Estuarine environment, *Abstracts, Mollusks, Crustaceans, Benthic fauna, Annelids, Water quality, Disposal, Primary productivity.
Identifiers: *Annotated bibliographies, *Estuarine organisms, Literature reviews.

This annotated bibliography was prepared by screening approximately 1200 published and unpublished articles, papers, and books. Abstracts of 161 references are presented for all papers on the effects of suspended loads and deposited sediments on estuarine organisms. Articles are classified into 9 categories (Annelid worms, crustaceans, benthic species, engineering activities, mollusks, offshore disposal, fish, primary production, and sediment effects on water quality). Also included is a list of 18 references constituting a bibliography of bibliographies. (Sjolseth-Washington)
W70-08386

THERMAL GRADIENTS IN RIVERS AND RESERVOIRS DUE TO HEATED PLANT EFFLUENTS,
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W70-08423

LIMNOLOGICAL CONDITIONS IN VOLTA LAKE, THE GREATEST MAN-MADE LAKE OF AFRICA,
Ghana Academy of Sciences, Accra. Inst. of Aquatic Biology.
For primary bibliographic entry see Field 02H.
W70-08445

ESTUARINE RADIOECOLOGY - A BIBLIOGRAPHY OF REPORT LITERATURE,
Department of the Interior, Washington, D.C. Office of Library Services.
For primary bibliographic entry see Field 10.
W70-08470

INFLUENCE OF LOG HANDLING PRACTICES ON WATER QUALITY,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
Frank D. Schaumbury.
In: Water studies in Oregon, Oregon State University Water Resources Research Institute Fall Quarter 1969 Seminar WR012.69, Corvallis, p 1-9, January 1970. 9 p, 7 fig.

Descriptors: *Water pollution sources, *Lumbering, *Wood wastes, Bark, Oxygen demand, Lignins, Dissolved oxygen, Toxicity, *Water pollution effects.
Identifiers: Log storage, Floating logs, Log handling.

Current logging and log handling practices contribute measurably to the pollution of natural waters in the Pacific Northwest. The significance of this contribution, however, must be carefully evaluated in each location where logging operations are underway. Logs held in water storage release measurable quantities of soluble substances to the holding water. Some of the substances add color to the water and some provide a food source for bacteria and other microorganisms ever present in the water. As more food is made available by this 'leaching' or diffusion process, more dissolved oxygen is consumed by the active microorganisms. If an excessive quantity of food material enters the water, the dissolved oxygen concentration in the water may be reduced below the minimum level required by fish and other aquatic life. Sunken bark forms a benthic deposit which provides a food source for microorganisms. The decomposition of bark creates a demand for dissolved oxygen from the overlying water. (See also W70-08475). (Knapp-USGS)
W70-08476

RADIONUCLIDE ACCUMULATION IN COLUMBIA RIVER BIOTA,
Oregon State Univ., Corvallis. Environmental Health Sciences Center.
For primary bibliographic entry see Field 05B.
W70-08478

MERCURY CONTAMINATION IN THE NATURAL ENVIRONMENT,
Bureau of Commercial Fisheries, Ann Arbor, Mich.; and Dept. of Interior, Washington, D.C. Office of Library Services.
For primary bibliographic entry see Field 05A.
W70-08541

5D. Waste Treatment Processes

A GENERALIZED COMPUTER MODEL FOR STEADY-STATE PERFORMANCE OF THE ACTIVATED SLUDGE PROCESS,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
Robert Smith, and Richard G. Eilers.
Available from the Clearinghouse as PB-192 764, $3.00 in paper copy, $0.65 in microfiche. Water Pollution Control Research Series, October, 1969. 80 p, 5 tab, 43 fig, 41 ref, 3 append. FWQA Project 17090--10/69.

Descriptors: *Activated sludge, *Model studies, *Computer models, *Computer programs, Mathematical models, Waste water treatment, Aeration, Biodegradation, Biological treatment, Nitrification, Oxygen requirements, Oxidation, Dissolved oxygen.

Mathematical models used to represent the activated sludge process are examined; means of analysis and computation of the differences and similarities between models are investigated. Two digital computer programs have been developed. The first program, the Continuous Steady State Activated Sludge (CSSAS) is a steady state model of the conventional activated sludge process flexible enough to simulate any of the proposed models. The second digital program Fill and Draw Activated Sludge (FADAS) attempts to simulate the biological activity in a fill and draw bench experiment in which activated sludge is mixed with substrate in any proportions. The FADAS program which has not been validated will be useful in interpretation of bench scale fill-and-draw experiments. The CSSAS program represents the most complete state-of-the-art computational procedure for quasi-steady-state performance of the activated sludge process but some important questions relating to design and operation of the process remain unresolved. However, further experimentation should ultimately result in a thoroughly reliable design tool.
W70-08165

STUDIES ON LIMESTONE TREATMENT OF ACID MINE DRAINAGE, OPTIMIZATION AND DEVELOPMENT OF IMPROVED CHEMICAL TECHNIQUES FOR THE TREATMENT OF COAL MINE DRAINAGE.
Bituminous Coal Research, Inc., Monroeville, Pa.

Available from the Superintendent of Documents, U.S. Gov't Printing Office, Washington, D.C., 20402-Price $1.25. Water Pollution Control Research Series, DAST-33, January, 1970. 96 p, 25 tab, 29 fig, 22 ref. FWQA Project 14010 EIZ---1/70.

Descriptors: *Coal mine wastes, *Neutralization, *Oxidation, *Sludge treatment, *Acid mine drainage, Limestones, Ferrous iron, Electrophoresis, Coagulation, Waste water treatment.
Identifiers: Magnetic sludges, Sludge removal, *Limestone treatment.

Four actual coal mine waters have been neutralized with limestone both on a batch scale and by utilizing a continuous flow apparatus. Variations in treatment procedure were necessary depending on the characteristics of the individual waters. A standarized test was established to evaluate the reactivity of the limestones. The following variables are of importance in evaluating limestones for coal mine water neutralization: (a) particle size, (b) Ca and Mg content, and (c) surface area. Ferrous iron oxidation has been accomplished with both synthetic and actual coal mine water at low pH in the presence of coal-derived activated carbon. Electrophoretic mobility studies on precipitates obtained by both lime and limestone neutralization of coal mine water yielded information which can be

pplied for more effective sludge removal. Magetic sludges were prepared using two different on-bearing waters. The conversion of precipitates a magnetic form results in significant reductions settled sludge volumes as well as increases in lids content, compared to the initially formed udge obtained by lime neutralization alone. Data btained in these studies indicate that the mestone process offers considerable promise for improved lower cost method for treating several pes of coal mine waters.
/70-08167

NDUSTRIAL WATER RECIRCULATION IN ORTHEASTERN ILLINOIS,
linois State Water Survey, Naperville.
or primary bibliographic entry see Field 03E.
/70-08228

WATER/WASTE WATER GUIDE TO EUOPE, PART I: TREATMENT PRACTICES,
etroit Metropolitan Water Services, Mich.
lichael J. Taras.
/ater and Sewage Works, Vol 116, No 1, January 969. p 10-15.

escriptors: *Water treatment, *Water purificaon, *Waste water treatment, *Ozone, Chlorinaon.
lentifiers: *Ozonation, Europe.

his is the result of an eight-week survey of orthern European water and waste water treatent practices. Subjects covered include an overiew of European practice: ozonation, chlorinaon, flouridation, Russian treatment practice, utch treatment, practice, and the Rye Meads terary treatment plant. Treatment practices in Euope include combinations of impoundment reserirs, percolation through sand dunes, microstrainng, chlorination, ozonation, coagulation with hemicals, activated carbon adsorption, sedimentaon, and rapid and/or slow sand filtration. Europen water is harder than American water, and Euopeans often complain they see too many water oftening installations in their tours of the U.S. zonation is gaining popularity in Europe, both rom a standpoint of decreased cost of chemicals nd avoidance of formation of chlorophenols. hlorination and chloramination remain the domiant disinfectants of European water supplies. Rusian treatment practices resemble U.S. practices. In ddition to the rapid sand filter, the Russians use he new AKAHA filter which embodies and collecion pipe system in the middle of the sand bed, nabling water to be filtered by gravity through the pper portion of the bed, and by upflow through he lower portion of the bed. (Makela-Texas)
/70-08293

A WATER/WASTE WATER GUIDE TO EUROPE: PART 2: ANALYTICAL METHODS,
Detroit Metropolitan Water Services, Mich.
Michael J. Taras.
Water and Sewage Works, Vol 116, No 2, February 969, p 50-55. 1 tab.

Descriptors: *Water treatment, *Water purificaion, *Waste water treatment, *Water pollution, Analysis, *Analytical techniques, *River basin commissions, Standards.

Three books of analytical methods of examining water/waste water are found in widespread use in Europe. One is compiled by each nation with the im of standardizing results among the laboratories f that nation. The other two books are the latest editions of the World Health Organization Internaional Standards for Drinking Water and the Amercan Standard Methods for the Examination of Water and Waste water. Coliform counts are obained by multiple tube lactose broth fermentation nd membrane filter. The London Metropolitan Water Board has developed a synthetic glutamic acid medium which achieves better results than the conventional lactose broth. European analytical trends tend to parallel those of the U.S. Virtually all European laboratories possess a filter photometer and an ultraviolet-visible range spectrophotometer. Infrared and atomic adsorption spectrophotometers are gaining in popularity. A new apparatus named the Vorth Sapromat has received much consideration for its applicability in the analysis of biological treatment of waste water. The tendency in Europe is toward regional pollution control agencies, usually based on a whole river basin. These agencies, like the Emscher Association, regulate drainage conditions and waste water treatment in the river basin. Membership in the authority is mandatory, and financing is guaranteed by assessments on the members in proportion to the volume and noxiousness of their waste discharges. (Makela-Texas)
W70-08294

BUTTERFLY VALVES INSTALLED WITHOUT INTERRUPTION IN WATER SERVICE,
Pratt (Henry) Co., Aurora, Ill.
Bruce F. Ranney.
Water and Sewage Works, Vol 116, No 9, p 354-355, September 1969. 4 fig.

Descriptors: *Water distribution, *Valves, *Pressure conduits, Installation.
Identifiers: *Butterfly valve, *Line plug, Aurora, Illinois.

The main pumping station in the water distribution system of Aurora, Illinois, was successfully isolated so that repairs and maintenance work could be performed without interruption in service. The project consisted of the installation of two butterfly valves while the 16 inch distribution lines were under pressure. Advance valve installations performed the project by installing 2 plugs into the 16 inch mains with their special equipment. These plugs restrained the city water pressure while the butterfly valves were being installed. The valves were installed in less than two days. Similar installations can be made at sewage treatment plants where the same general type of valve difficulty occurs. (Galwardi-Texas)
W70-08295

INVESTIGATION AND REPAIR OF EXISTING SEWERS,
Underwater Tel-Eye Ltd. (Canada).
K. F. Perkins.
Water and Pollution Control, Vol 107, No 11, November 1969, p 32-33.

Descriptors: *Sewers, *Investigations, *Photography, Repairing, Pipes.
Identifiers: *Television cameras.

The technology of detection of sewer problems has been advanced by the introduction into the technology of photographic and television equipment. Cameras available include both two dimensional and three dimensional still photo cameras and battery operated motion picture cameras. Disadvantages of photographic equipment are the limited film load with its accompanying large interval between pictures, and inability to detect equipment malfunction or line blockage until the film is developed or the camera becomes stuck. The use of closed-circuit television avoids both these problems. It allows instantaneous viewing, with the capabilities of stopping the camera for study of a given area. Photographs can be taken from the surface monitor for future reference. TV cameras also show more detail than the naked eye can pick up. The camera can be repositioned to study the same area from different positions. Photographic systems should be more costly to operate than television systems due to reshooting costs, extensive picture review time, and film developing costs. In addition to use for inspection of existing sewer lines for problems, the television system can be used to inspect new lines prior to acceptance by the municipality. Even the contractor can use this service. (Makela-Texas)
W70-08296

FEDERAL GRANTS FOR MUNICIPAL WASTE TREATMENT--THE NEED FOR POLICY CHANGE,
Municipality of Metropolitan Seattle, Wash.
James R. Ellis.
Journal of the Water Pollution Control Federation, Vol 42, No 5, Part 1, p 679-684, May 1970. 1 tab, 2 ref.

Descriptors: *Grants, *Sewage treatment, *Legislation, Governments, Costs, Federal Government, Waste water treatment, Sewage, Construction.
Identifiers: *Incentives, Bonds, Growth.

The biggest problems are in big cities; however, the large metropolitan areas have been neglected sadly by the federal government and it is time to shift the balance. This can be done by adopting six changes in our federal policy. (1) Redress the large city inequity by authorizing incentive grants for qualifying new projects. (2) Make combined sewer overflow abatement facilities eligible for federal grants. (3) Make the federal grant commitment reliable as to receipt and adequate as to dollars. (4) Strengthen the market for local bonds by renouncing the abortive effort to tax municipal bonds by redressing the supply-demand equation by substantial federal support. (5) Develop regulatory standards which encourage local communities to direct their worst local problems and which will get the most pollution abatement for each federal and local tax dollar. (6) Encourage the local use of sewer service charges by offering a federal grant incentive, but do not permit any industry to destroy any stream for a fee. (Hancuff-Texas)
W70-08297

OXNARD SEWAGE PLANT SOLVES ODOR CONTROL PROBLEM,
Oxnard, Calif.
Stanley G. Pateman.
Water and Sewage Works, Vol 116, No 10, p 352-353, October 1969. 3 fig.

Descriptors: *Waste water treatment, *Odor, *Control systems, *Costs, *Industrial wastes, California.
Identifiers: *Farm produce wastes, *Malabate reodorants, Oxnard (California).

The Oxnard waste treatment plant has solved an extremely difficult odor control problem which resulted from the treatment of farm produce processing wastes. The system consists of fog spray nozzles which distribute a series of Malabate reodorants. The Malabates chemically treat the odors, not just mask them without raising the odor level. The Malabate reodorants do not corrode nozzles or pumps. Total installation cost of the complete system was less than $3,200 and chemical costs average less than $3.50 per day. The system is used only 6 to 8 hours per day. (Galwardi-Texas)
W70-08298

ARE PAVED DRYING BEDS EFFECTIVE FOR DEWATERING DIGESTED SLUDGE.
Virginia Polytechnic Inst., Blacksburg.
Clifford W. Randall.
Water and Sewage Works, Vol 116, No 10, p 373-376, October 1969. 6 fig, 1 tab, 7 ref.

Descriptors: *Sludge, *Sludge treatment, *Sewage sludge, *Dewatering, *Dry beds.
Identifiers: *Digested sludge.

The usefulness of paved sludge beds of center drain design for dewatering aerobically digested activated sludge is evaluated to determine if they provide a more economical solution than conventional sand beds. Paved bed design permits use of mechanical equipment for cleaning and thereby reduces the cost of labor and sand replacement. Anaerobically digested sludges dewater readily on partially obstructed paved beds due to the lateral drainage of water to the unobstructed portion of the bed. In this study, four beds were prepared, two of which were paved except for the center drain,

and two of which were conventional sand beds. Activated sludge from a municipal treatment plant was dried in 8 and 4-inch layers on the two types of beds. Sludge on the sand beds dewatered to less than 15% moisture content within 7-9 days for the 4 to 8-inch sludge layers, respectively. The sludges on the paved beds drained very slowly and after 10 days were still saturated. The author concludes that paved beds of center drain design are not desirable for dewatering aerobically digested sludge. Lateral drainage is poor and does not significantly contribute to the dewatering process. The poor drainage was not due to air binding of the sand drain, but to the nature of the sludge itself. (Makela-Texas)
W70-08300

TYPES OF ACTIVATED SLUDGE WHICH SEPARATE POORLY,
Northwestern Univ., Evanston, Ill.
Wesley O. Pipes.
Journal of the Water Pollution Control Federation, Vol 41, No 5, p 714-724, May 1969. 7 fig, 18 ref.

Descriptors: *Activated sludge, *Settling basin, *Sludge, *Settling velocity, *Aeration, Biochemical oxygen demand, Microorganisms, Growth stages, Performance, Sewage treatment, Waste water treatment.
Identifiers: *Bulking, Characteristics, *Sludge volume index.

Practically all problems of the activated sludge process are manifest by poor separation of sludge in the secondary sedimentation tank and an increase in effluent BOD because of respiratory oxygen consumption by sludge or organisms in the effluent. Loss of sludge organisms in the effluent may be caused by any or all of three things. (1) Poor design of the secondary sedimentation tank which results in the loss of septic sludge or billowing sludge in the effluent. (2) Rising sludges produced by biological phenomenon when overaerated sludge is produced by mechanical phenomenon. Both of these phenomenon are understood well and can be eliminated by corrections in the operation of the aeration tank. (3) The formation of a type of sludge which settles poorly. Dispersed growth, while not actually a form of activated sludge may form in an activated sludge process. Continuous formation of the dispersed growth indicates the entire waste treatment system was conceived poorly and should be redesigned completely. Bulking sludge, floating sludge, pinpoint floc, and deflocculated sludge are each complexes of several different types of sludge. Each needs further study before separation into component types and solution to specific problems is possible. Given adequate capacity in secondary sedimentation tank and return sludge pumps an activated sludge process can be operated successfully with a bulking sludge to produce an excellent quality effluent. There is no known way to get a good quality effluent from an activated sludge process which is producing large quantities of floating sludge, pinpoint floc or deflocculated sludge. (Hancuff-Texas)
W70-08301

INFLUENCE OF TURBULENCE ON THE ACTIVITY OF ACTIVATED SLUDGE FLOCS,
Technische Hochscule, Karlsruhe (West Germany)
L. Hartmann, and G. Laubenberger.
Journal of the Water Pollution Control Federation, Vol 40, No 4, p 670-676, April 1968. 8 fig, 3 tab, 4 ref

Descriptors: *Turbulence, *Oxygenation, *Reynolds number, *Activated sludge, Dissolved oxygen, Microorganisms, Temperature, Flocculation.
Identifiers: *Uptake rates, *Oxygen tension

Experiments related to the influence of turbulence on the activity of activated sludge flocs reveal the following results. (1) At high concentrations of organic material in the mixed liquor the transport of oxygen from the environment to the cell surface is the rate limiting link in the chain of biodegradation reactions. An increase in the oxygen pressure in the environment also results in an increase in the oxygen consumption by the floc. (2) Turbulence has a double influence; (a) the breaking apart of the agglomerated flocs into the bacterial colonies which are the smallest units of the floc, and (b) the exchange of contact area between bacteria and environment. Both phenomenon result in an increase of oxygen uptake. (3) Deflocculation starts while the fluid is still in laminar movement and extends to some degree into turbulent conditions. At Reynolds Number of around 5000 no further influence of water movement on the physical properties of the floc seem to occur. The influence of turbulence on the exchange of the contact layer between bacteria and water occurs mainly between Reynolds Numbers of 5000 and 9000. (Hancuff-Texas)
W70-08302

UNIT PROCESS PERFORMANCE MODELING AND ECONOMICS FOR CANNERY WASTE TREATMENT,
Water Resources Engineers, Inc., Walnut Creek, Calif.; and San Jose State Coll., Calif.
Denny S. Parker, John R. Monser, and Robert G. Spicer.
Proceedings, Industrial Waste Conference, 23rd, May 1968, p 710-739. 10 fig, 14 tab, 18 ref.

Descriptors: *Canneries, *Cost analysis, *Design criteria, *Economic efficiency, *Economics, *Optimization, Design data, Economic feasibility, Efficiencies, Model studies, Performance, Waste treatment, Waste water treatment.
Identifiers: *Unit processes, Waste characteristics.

Data from several unit processes was analyzed with reference to one particular cannery waste for the development of optimal design criteria. Due to the nature of the data, the input requirements for the system design procedure were termed cost-size-efficiency (C-S-E) relationships. Twelve alternative unit processes are analyzed including: activated sludge, lagoons and chemical waste treatment systems. In the system optimization analyses, the C-S-E relationships were used to determine the minimum cost solution. Design data and costs for an 8 MGD activated sludge plants are presented for the least cost solution for each level of efficiency. At the lower efficiencies, aeration costs go down, but clarification costs rise. A linear regression model predicting BOD removal efficiency is presented for lagoons, although the use of lagoons is not recommended for cannery wastes due to the lack of nitrogen and the shock loading a lagoon receives when the canning season begins. Chemical precipitation combined with sedimentation allowed BOD removals to approach 50%. Chemical oxidation with potassium permanganate offers attractions in its simplicity of operation and ease of control. Economic considerations would be the main determinant in its selection. (Aguirre-Texas)
W70-08303

CHEMICAL CONDITIONING OF BIOLOGICAL SLUDGES FOR VACUUM FILTRATION,
Notre Dame Univ., Ind.
Mark W. Tenney, Wayne F. Echelberger, Jr., John J. Coffey, and Timothy J. McAloon.
Journal of the Water Pollution Control Federation, Vol 42, No 2, p RI-20, February 1970. 12 fig, 1 tab, 28 ref.

Descriptors: *Activated sludge, *Dewatering, *Flocculation, *Sewage treatment, *Sludge, *Vacuum drying, Filtration, Sludge treatment, Waste water treatment.
Identifiers: *Conditioning, *Polyelectrolytes, Chemical treatment, Flocculants, Flocculating, Sludge drying.

Polymeric flocculation produced biologically is a properly operating activated sludge process are not effective as sludge conditioners of waste sludge for dewatering by vacuum filtration. It is necessary to add chemical conditioners or synthetic organic polyelectrolytes to structure properly the waste activated sludge. Conditioner dosage was found to be affected by the carriage waste water quality parameters of pH, alkalinity, and phosphate concentration; and the sludge parameters of solids concentration, storage lime, and primary sludge mix ratio. The optimum pH for effective conditioning of the sludges tested was in the range of 6.0 to 7.0 for iron (III) and 4.5 to 5.5 for aluminum (III). An increase in either alkalinity, phosphate concentration, solids concentration, storage time, and primary sludge mix ratio required an increase in conditioner dosage necessary to enhance the dewatering of waste activated sludge. (Aguirre-Texas)
W70-08304

TREATABILITY STUDIES OF INDUSTRIAL WASTES EFFECTED THROUGH PROCESS SIMULATION,
Prosearch Ltd., Oakville (Ontario).
Robert W. Baker, and Frank Guillaume.
Water and Sewage Works, Vol 116, No 9, p 32-38, September 1969. 15 fig, 1 ref.

Descriptors: *Simulation analysis, *Industrial wastes, *Design criteria, *Waste water treatment, Lagoons, Biological treatment, Performance, Oil, Poultry.
Identifiers: *Treatability studies, Unit operations, Clarifier, Aerated Lagoons.

The importance of treatability studies effected through process simulation of the unit operations involved in a waste water treatment plant is emphasized. Treatability studies can be used to predict the cost-effectiveness of different unit operations. Effects on a waste treatment plant from new product development or changes in production techniques can safely and accurately be predicted in the laboratory using simulation techniques. Four case histories are presented. A clarifier performance comparison showed that suspended solids removal would be a fraction of what would be anticipated from using the widely accepted design criteria. The percentage of total carbon removed varied between 1.0 and 2.5 per cent and was independent of the hydraulic loading rate over the range investigated. Case No 2 involved a petrochemical complex discharging waste into a conventional lagoon. Studies showed that biological treatment was not an acceptable means of treatment. Case No 3 involved a chicken packing house waste and results showed that a partially mixed aerated lagoon would procide adequate treatment and that a completely mixed aerated lagoon would not be necessary. The last study relates to the frequent problem of a plant designed and built for a projected hydraulic and pollutional load which will not be attained for several years. (Galwardi-Texas)
W70-08305

TRANSIENTS IN THE ACTIVATED SLUDGE PROCESS,
Sterling Drug, Inc., Rothschild, Wis. Zimpro Div.
Paul V. Knopp, Donald G. Watts, and Gerald A. Rohlich.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 894-913. 10 fig, 1 tab, 23 ref.

Descriptors: *Activated sludge, *Dynamics, *Effects, *Frequency analysis, *Organic loads, Model studies, Mathematical models, Organic matter, Variability, Waste water treatment.
Identifiers: *Shock loads, *Transients, Concentration.

Aspects of modeling the dynamics of the completely mixed activated sludge process are discussed and estimates of the effects of variation in the concentration of organic material in the treatment plant effluent are presented. The usefulness of frequency response analysis of input-output records from the activated sludge process was demonstrated. COD was shown to be a poor indicator of system

sponse and can probably be attributed to the fact at the COD measurement is far too gross a measurement to indicate the dynamic changes within e system. The activated sludge system can be escribed as a low frequency pass system. Further ork is required to determine the effect of variaon in flow, and finally, joint frequency response nalysis of systems for which both flow and concenation vary with time. Frequency response analysis actual operating plants is recommended as a eans of explaining output variation and to assist developing models for the control of the acvated sludge process. (Aguirre-Texas)
70-08306

CONOMICS OF AERATION IN WASTE REATMENT,
mco Corp., Salt Lake City, Utah.
. A. Kalinske.
roceedings Industrial Waste Conference, 23rd, ay 1968, p 388-397. 3 fig, 6 ref.

escriptors: *Activated sludge, *Aeration, Economics, *Equipment, *Lagoons, *Waste eatment, Biological treatment, Waste water treatent.
entifiers: Diffused aeration, Mechanical aeration, rface aerators, Turbine aerators.

he economics are discussed of aeration for those robic processes where the organisms are kept in spension in the liquid waste; primarily the acvated sludge process and all its modifications, and -called aerated lagoons. Three principal oxgenation methods presently in use are: diffusion of mpressed air, diffused air with submerged turne dispersers, and mechanical surface entrainent aerators. Diffused air systems will average out double the power consumption of well esigned mechanical-type surface entrainment erators. Installation costs also favor the mechanial surface-type aeration systems. High strength astes can best be treated with activated sludge aving the O2 supplied by mechanical means. Use surface aerators in large lagoons can be the neapest method for treatment of a wide variety of dustrial wastes. The non-steady, clean water test chnique is the most useful and practical for valuating the O2 input efficiency of aeration quipment. The main factor that must be given areful attention is that the basic contents are roperly mixed by the aerator. (Aguirre-Texas)
70-08307

IOLOGICAL TREATABILITY OF VARIOUS IR FORCE INDUSTRIAL WASTES,
elly AFB, Tex.
ames A. Mueller, and Walter W. Melvin, Jr.
roceedings Industrial Wastes Conference, 23rd, lay 1968, p 398-427. 20 fig, 8 tab, 4 ref.

escriptors: *Biological treatment, *Industrial astes, *Laboratory tests, *Toxicity, Biochemical xygen demand, Biodegradation, Chemical oxygen emand, Military reservations, Oxygen demand.
dentifiers: *Air Force, *Treatability, Field studies.

iodegradability studies on specific Air Force industrial wastes have indicated that many of these astes can be treated in a biological treatment ystem. These studies gave the toxic levels of these astes and degree of treatment to be expected in a omestic treatment plant. The wastes resulting rom paint stripping of aircraft, fire fighting foam, nd disinfecting operations were studied in the aboratory to determine biodegradability. Paint tripping waste at COD concentrations from 1000 3000 mg/l gave maximum removal rates. Above 000 mg/l COD the waste became toxic to the oranisms. The BOD5 value for the paint stripping aste was about 1/3 of the COD value, whereas the ffluent was about 1/8 the COD value. The fire ghting foam waste was not toxic to activated ludge microorganisms at COD concentrations of ,000 mg/l and to waste stabilization pond microoranisms at COD concentrations of 16,000 mg/l. OD removal for the ponds containing foam wastes averaged 94%. Formaldehyde from the disinfecting operations waste was completely removed from solution in 3 hours, by activated sludge, when the initial concentration was less than 30 mg/l but was only partially removed at concentrations of 100 mg/l or above after 8 hours aeration. (Aguirre-Texas)
W70-08308

THE ROLE OF PARTICULATE SUBSTRATES IN BIOTIC DEGRADATION OF ORGANIC MATERIALS,
Missouri Univ., Columbia.
Darrell L. King, and Rameshwar D. Verma.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 75-86. 1 fig, 5 tab, 16 ref. OWRR-A-007-MO.

Descriptors: *Biodegradation, *Organic matter, Biochemical oxygen demand, Growth rates, Laboratory tests, Metabolism.
Identifiers: *Particulate substrates, Bacterial activity, Biological oxidation, Media.

Much of what is known about the activity of microbiological communities in the degradation of organic materials is based on studies in which the organic substrate was glucose present in the dissolved phase. Most wastes contain a significant amount of particulate material which serves as an attachment site for the heterotrophic microbiota and in many cases this available surface exterts a marked effect on bacterial activity. The objectives of this study were to determine the effects of the physical state of organic media on the metabolism of a complete aerobic community of microorganisms and on the bacterial portion of that community. The interactions between particulate material and increasing concentrations of dissolved organic nutrients available to the biota also were considered. From this study it became apparent that the presence of particulate materials in organic waste streams plays a significant role in determining the type and extent of energy fixation and utilization by populations of heterotrophic microorganisms. When particulate surface was available for bacterial colonization the energy conversion efficiency was roughly 50% while in the dissolved media only about 14% of the energy released during biotic activity was channeled into new biomass. (Aguirre-Texas)
W70-08309

DISSOLVED - AIR ION FLOTATION OF INDUSTRIAL WASTES HEXAVALENT CHROMIUM,
Kentucky Univ., Lexington.
Robert B. Grieves, Gregory A. Ettelt, J. Thomas Schrodt, and Dibakar Bhattacharyya.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 154-164. 5 fig, 2 tab, 10 ref.

Descriptors: *Chromium, *Efficiencies, *Foam separation, *Optimization, *Regression analysis, Industrial wastes, Pilot plants, Surfactants.
Identifiers: *Floatation, *Ion flotation.

Efficiency of a pilot-plant scale, dissolved air ion flotation unit for the removal and concentration of dichromate is evaluated. Data obtained are subjected to a multiple regression analysis involving polynomial expressions. Equations, accurately representing the data are generated which relate the fractional flotation (removal) of dichromate, the enrichment ratio for dichromate, and the fractional flotation of surfactant to the five independent variables that were considered. The optimum values of the independent variables were: a polymer dosage 3.2 or 4.8% of the feed concentration of dichromate, a molar feed ratio of surfactant to dichromate of 2.1, 170% recycle, a detention time of 85 minutes, and a feed concentration of dichromate of about 100 mg/l. Including a feasible process of surfactant recovery, the approximate chemical cost is about $0.67 per lb of chromium. The primary advantage of the dissolved-air, ion flotation is the concentration of the chromium in a liquid volume less than one per cent of the volume of the waste. (Aguirre-Texas)
W70-08310

AEROBIC THERMOPHILIC PROCESS FOR THE BIOLOGICAL TREATMENT OF WASTES--SIMULATION STUDIES,
Clemson Univ., S.C.
Kawi Kambhu, and John F. Andrews.
Journal of the Water Pollution Control Federation, Vol 41, No 5, p R127-141, May 1969. 12 fig, 2 tab, 18 ref.

Descriptors: *Biological treatment, *Mathematical models, *Waste water treatment, *Simulation, *Thermophilic bacteria, Aerobic treatment, Digestion, Disposal, Temperature.
Identifiers: Garbage.

A mathematical model is developed for a thermophilic process using material balances for sludge and garbage, based on a complete-mixing, continuous-flow reactor with the reaction rate constant being expressed as a function of temperature. Oxygen, energy, and heat balances are made. Sufficient heat can be obtained through thermogenesis to maintain thermophilic temperatures (45 deg to 65 deg) thus making the process autothermal. The results presented should be considered only semiquantitative in nature since reliable values are not available for the effect of temperature on the rate constant. The simulations presented are for a mixture of primary plus waste activated sludge from a city of 10,000 population. Per capita contribution of total solids is assumed to be 0.2 lb/day of which 70% is volatile. Of the volatile solids, 70% is assumed to be biodegradable. Since low temperatures will be critical for the process, an outside air temperature of 2 deg C and an influent sludge temperature of 2 deg C are used. Oxygen requirements are assumed to be 1.4 lb of oxygen/lb of VS destroyed. Reactor temperatures over 100 deg F are attained at all residence times greater than 5 days. Too high an aeration rate can lower the reactor temperature and decrease the percentage of VS destroyed. Higher temperatures and increased VS destruction can be obtained by using thickening to increase the influent sludge solids concentration. (Aguirre-Texas)
W70-08311

ADVANCES MAKE WASTE WATER FILTRATION ECONOMICAL AND EFFECTIVE SOLUTION,
Graver Water Conditioning Co.
Robert Dvorin.
Industrial Wastes, Vol 116, No 9, p 12-16, Sept 1969. 5 fig, 6 ref.

Descriptors: *Waste water treatment, *Filtration, *Deep will pumping, *Municipal wastes, Tertiary treatment.
Identifiers: *Dual media, *Air scouring, *Bed depth, *Steel mill wastes.

Filtration technology progress has increased the applications of filters for waste water treatment flow rates have increased to 5-15 gpm/sq.ft with the use of dual media and increased bed depths. Also waste waters containing higher concentrations of suspended solids can be filtered. Air scouring is required along with conventional water backwash on filters operating on high concentrations of suspended solids. An underdrain system, Roto-Scour, discharges all the air and water within 1/4 inch of the filter bottom. Thus applications of filters operating on waste water are steel mill scale filters, municipal tertiary treatment filters and deep well disposal filters. Filters treating a steel mill scale waste having a suspended solids concentration of 100-150 mg/l can be operated at a flow rate of 15 gpm/sq ft. with a cycle time of 12-16 hour and produce an effluent normally containing less than 10 mg/l suspended solids. Tertiary filters can reduce suspended solids from 20-40 mg/l to less than 5 mg/l with a flow rate of 5-7 gpm/sq.ft. Wastes containing between 10-200 mg/l suspended

solids have been filtered before deep well disposal. (Aguirre-Texas)
W70-08312

EFFECTS OF LOADING ON A BIOLOGICAL TERTIARY TREATMENT SYSTEM,
Washington Univ., Seattle.
H. Kirk Willard, and D. A. Carlson.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 740-753. 9 fig, 3 tab, 20 ref.

Descriptors: *Biological treatment, *Mathematical models, *Tertiary treatment, Activated sludge, Effects.
Identifiers: *Aufwuchs biocoenose, *Loadings, *Particulate removal, Suspended solids.

A new two-phase biological tertiary waste treatment system has been proposed. It includes an aerobic bacterial growth unit and a particulate removal unit. In a study of the second phase, the effects of SS loading on a community of attached particulate feeding organisms were determined. Bacterial substrate utilization and growth of the aufwuchs biocoenosis could be described as follows: F (S0-S1) = mu (S1) (A) (gamma)/ (Ks+S1)Y. The maximum growth rate constant mu was determined to be 0.026 and the half-rate constant Ks was 6.2 mg/l. A biomass yield of 16% of the influent SS for the particulate feeders produced a low effluent solids concentration of only 0.069 mgSS/mg BOD removed. Total dissolved organic carbon was over 90% destroyed in the bacterial and aufwuch's units. Similar removal values of 90 to 94% were measured for BOD. The decreases of both organic carbon and BOD were higher at lower loading rates. A method for the rapid removal of SS and carbonaceous materials can now be used based on a rational mathematical approach. (Aguirre-Texas)
W70-08313

EVALUATION OF THE KRAUS MODEL OF ACTIVATED SLUDGE BULKING,
Northwestern Univ., Evanston, Ill.
Wesley O. Pipes, and Frank S. Meade.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 111-125. 5 fig, 7 tab, 8 ref.

Descriptors: *Activated sludge, *Evaluation, *Kinetics, *Mathematical models, *Sludge, Biochemical oxygen demand, Organic matter, Sludge treatment.
Identifiers: *Bulking, *Kraus Model, *Sludge volume index, Solids.

Most of the proposed kinetic models of the activated sludge process interpret effluent BOD as being caused by organic matter which was originally present in the influent waste, but not removed in the aeration tank. Sludge solids lost in the effluent from the secondary settling tank will cause a high effluent BOD which is not due to unchanged organic matter from the influent. Bulking sludge can lead to the loss of sludge solids in the effluent, the amount of which could be predicted from the sludge volume index in a formulation developed by Kraus. An evaluation of the Kraus model was made based on two hypotheses: (1) the sludge volume index of a sludge sample remains constant with respect to time if no new sludge particles are formed, and (2) the sludge volume index of a mixture of two different sludge samples is the weight fraction sum of the SVI of each sample. The SVI of most samples of normal sludge (SVI 100 ml/gm) will remain constant during aeration for a few days. The mixture of two different sludge samples is not necessarily the weight fraction sum of the SVI of each sample. (Aguirre-Texas)
W70-08314

INSTRUMENTATION FOR RESEARCH ON BIOLOGICAL PROCESSES,
Moore Products Co., Knoxville, Tenn.
Charles W. Crawford, Kawi Kambhu, and John F. Andrews.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 1039-1053. 16 fig.

Descriptors: *Automatic control, *Biological treatment, *Data processing, *Instrumentation, *Research equipment, Control, Data collections, Data storage and retrieval, Digital computers, Measurement, Waste water treatment.
Identifiers: *Data acquisition system, Process variables.

Many of the limitations of previous studies on biological processes used for waste treatment have been due to the many variables involved, time requirements for bringing the microbial cultures to steady state, and a lack of control of some of the more important variables. Significant advances could be made in the solution of these problems by using appropriate instrumentation for automatic control and analysis of important variables and automatic collection and formating of data for direct entry into a digital computer by using a data acquisition system. Measurement and control of process variables includes: (1) Gas composition; (2) Gas flow rate; (3) Dissolved oxygen; (4) Temperature; and (5) pH. A beckman DEXTIR data system was used for the automatic collection and formating of data for direct entry into a digital computer. This is an expandable data acquisition complex which is designed to accept signals from various sensors located within several research laboratories and channel them to a centralized processing unit. The instrumentation and data acquisition systems described have only recently been placed in operation and the results of operating experience are therefore not available. (Aguirre-Texas)
W70-08315

PERFORMANCE OF INTERNALLY CLARIFIED ACTIVATED SLUDGE PROCESS TREATING COMBINED PETROCHEMICAL-MUNICIPAL WASTE,
Union Carbide Corp., South Charleston, West Va.
G. W. Kumke, R. A. Conway, and J. P. Creagh.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 567-582. 13 fig, 5 tab, 7 ref.

Descriptors: *Activated sludge, *Efficiencies, *Industrial wastes, *Municipal wastes, *Organic loading, *Performance, Chemical wastes, Oil wastes, Waste treatment, Waste water treatment.
Identifiers: *Internally clarified, *Joint treatment, *Petrochemical wastes.

A four-year evaluation of the treatment of a combined petrochemical-municipal waste in full-scale aerator-clarifier units has been completed. The performance data for this type of activated-sludge process indicate that the removal capacity of BOD5 from the mainly petrochemical waste at an 80% efficiency reaches 180 lb/day/1000 cu ft. aeration volume. An average removal of 130 lb BOD5/day/1000 cu ft. was obtained. A concentration of 5000 mg/l of highly active biological solids could be maintained to accommodate wide variation in waste water strength and constituents. The effects of detention time, organic loading, and sludge age on performance were delineated. BOD removal varied from 73 to 93% over a range in retention times of 5.5 to 15 hours. A gradual decline in BOD5 removal from 86% to 80% was observed with a loading increase of from about 130 to 230 lbs BOD5/day/1000 cu ft. Little correlation existed between sludge loading and BOD5 removal in range of 0135 to 1.6 lb BOD5/day/lb MLSS. The aeration solids were maintained between 4000 and 6500 mg/l throughout the four-year operating period to provide a buffer to accommodate the variability of the industrial waste. (Aguirre-Texas)
W70-08316

WASTES FROM THE PRESERVATION OF WOOD,
Mississippi State Univ., State College.
E. Joe Middlebrooks, and Erman A. Pearson.
Proceedings Industrial Waste Conference, 23rd, May 1968, p 213-228. 8 fig, 2 tab, 5 ref.

Descriptors: *Biological treatment, *Chemical precipitation, *Creosote, *Preservation, *Toxicity, *Wastes, *Wood preservatives, Laboratory tests, Oil phenols, Waste treatment.
Identifiers: Gulfport, Mississippi.

Little information is available dealing with the treatment of wood preservation wastes, and the results in this report should be useful as a guide in designing waste treatment facilities for other wood preservation plants. The waste contains toxicants but it is amenable to biological treatment. The COD of the effluent from the biollogical process ranged from 1600 to 2000 mg/l resulting in a removal of about 50%. A significant reduction (70%) in the chemical and biochemical oxygen demand was achieved by flocculating the waste with lime (CaO). Chlorination alone did not effectively reduce the COD of the waste. Chemical flocculation followed by chlorination reduced the COD of the waste by 85% and reduced the phenol concentration to less than 0.5 mg/l. (Aguirre-Texas)
W70-08317

SEWERAGE PLANNING IN GREATER STOCKHOLM AREA,
Stockholm City Municipal Services Dept. (Sweden).
Anders Cronstrom.
Water and Sewage Works, Vol 116, No 9, p 356-358, Sept 1969. 3 fig.

Descriptors: *Waste water treatment, *Sewage treatment, *Sewage disposal, *Sewerage, *Nutrients, *Regional analysis, Treatment facilities, Biochemical oxygen demand (BOD), Planning.
Identifiers: Stockholm (Sweden), Tunnel systems.

Intensive population redistribution within and to the Greater-Stockholm area is expected by the year 2000; consequently large and difficult sewerage problems will be created. Population in the area is expected to increase through urbanization from the present 1.5 million people to 2 to 2.5 million. Alternative regional plans for biological sewerage treatment are presented with an objective of constructing treatment plants which would provide at dry weather inflow and normal operating conditions an efficiency of 95% removal of BOD. One alternative calls for construction of a tunnel system to convey all sewerage to a treatment plant which would sewer the entire area and have an ocean discharge. The other alternative considers using existing plants along with new regional treatment plants and a tunnel system which would only serve as an outlet conduit to better receiving waters. The problem of nutrient removal is being investigated. (Galwardi-Texas)
W70-08318

BACTERICIDAL EFFECTS OF ALGAE ON ENTERIC ORGANISMS,
Texas Univ., Austin. Center for Research in Water Resources.
Ernst Davis, and Earnest Gloyna.
FWPCA Grant 18050 DOL. Technical Report EHE-70-06, CRWR-55, 132 p, Mar 1970. 9 fig, 144 tab, 60 ref.

Descriptors: *Algae, *Cultures, *Enteric bacteria, *Oxidation lagoons, *Pathogenic bacteria.
Identifiers: *Autogomistic effects, *Axemic cultures, *Dieoff rates, Aftergrowth, Blue-green algae, Field studies, Green algae, Laboratory studies.

A series of experiments involving the effects of blue-green and green algae on the dieoff rates of selected bacteria were conducted. Axemic cultures of Anabaena cylindrica, A. nidulans, Oscillatoria chalybia, Chlorella pyrenoidosa and Scenedesmus obluguus among others. Cultures of enteric bacteria species (Adcaligeues faecalis, Enterobacter aerogenes, E. coli, Proteus vulgaris, Psudomonas aerarginosa, and Serratia marcercens) were added to the oxenic algal cultures during different periods of the algal life cycles. Filtrate from actively growing algae was exposed to cultures of enterics to determine whether any antibiotic compounds were

parted to the medium during lag phase growth of gae. To determine aftergrowth of the enteric spe-es, the duration of the tests was extended to about days. Mixed cultures of green and blue-green gae were exposed to both single species of enteric cteria and mixed cultures. Mixed algal cultures use a greater dieoff among the enteric bacteria an do individual species of algae. The dieoff aracteristics of pathogenic species, namely Sal-onella typhosa, S. paratyplin, Shigella dysen-iae, S. paradysentesiae, and Vibrio comma were o determined. The pathogenic species did not rvive as long as the enteric test species under nilar test conditions. Virtually no aftergrowth s detected on the part of the pathogenes. guirre-Texas)
70-08319

TIMATION OF SLUDGE CENTRIFUGE PER-ORMANCE,
orsk Institutt for Vannforskning, Oslo.
Aarne Vesilind.
urnal, Sanitary Engineering Division, oceedings, American Society of Civil Engineers, ol 96, No SA3, p 805-818, June 1970. 11 fig, 1 o, 6 ref.

escriptors: *Sludge, *Centrifugation, *Dewater-g, Performance, Waste water treatment, Sewage eatment, Mathematical model, Sludge disposal.
entifiers: *Variables, Laboratory scale.

laboratory test is developed which yields quan-ative information on the expected performance centrifuges in dewatering of any particular dge. The laboratory tests were conducted at rious treatment plants around Scandanavia and e results correlated with prototype centrifuge rformance. Only the bowl or decanter type cen-fuges were tested as these are by far the most mmon machines used for sludge dewatering. aterials other than sludge were not considered d therefore, it can not be assumed that the tests ll be equally applicable to other materials. The riables effecting centrifuge performance are di-ded into two types of parameters--machine varia-es and process variables. The most important rameters are listed. The machine variables in-ude centrifugal force, pool depth, and scroll rota-onal speed. The process variables are residence ne and sludge characteristics. A model to scribe centrifugal dewatering accurately must in-ude some measure of the two processes necessary r successful operation, settling, and scrolling. The ttling characteristics are determined through ntrifugation of four 10-ml samples. Scrolling aracteristics are determined through a sludge netrometer used to measure the sludge penetra-on. A light fluffly sludge has a poor consistency d can not be scrolled and therefore results in a w reading. The numerical differences between edicted and actual performance can be expected be within plus or minus 10%. (Hancuff-Texas)
70-08320

ARIABILITY OF WASTE TREATMENT PER-ORMANCE,
anhattan Coll., Bronx, N.Y.
obert V. Thomann.
urnal, Sanitary Engineering Division, roceedings, American Society of Civil Engineers, ol 96, No SA3, p 819-837, June 1970. 15 fig, 3 b, 6 ref.

escriptors: *Waste water treatment, *Sewage eatment, *Performance, *Variability, *Statistics, athematical model, Data, Analysis.
entifiers: Theory, Primary treatment, Secondary eatment.

veral statistical techniques are applied to time riations of waste treatment processes restricted municipal plants. The purposes of a time series alysis of municipal waste treatment plant data e (1) gain further insight into the nature of the riability of flow and biochemical oxygen de-and, (2) to develop additional measures of performance of treatment plants which may prove useful in estimating future variabilities, and (3) to relate the behavior of the treatment plant to resulting stream quality variation. The results indicate a high degree of variability in secondary effluent BOD as measured by the coefficient of variation. Values range from 0.2 to 1.1. The distribution of this variance over frequency show a strong seasonal dependence for plants subjected to seasonal canning load, 5 day on and 2 day off oscillations were also noted in a power spectrum of several plants. For one plant the amplitude of this weekly oscillation is about 20% of the mean load. The results of the time series analyses also indicate the effect that load variability can have on the water quality of a stream. In the final analysis, this is the primary reason for being concerned with plant variations. Dissolved oxygen variations of 1.0 mg/l or greater appear to be possible from a mathematical model of the stream and the observed treatment plant spectrum. The theory indicates that the maximum DO variability will occur at the location of the critical DO deficit. (Hancuff-Texas)
W70-08321

EFFECT OF OXYGEN TENSION ON O2 UPTAKE AND SLUDGE YIELD IN COMPLETELY MIXED HETEROGENEOUS POPULATIONS,
Merck Sharp and Dohme Research Labs., Rahway, N.J.; and Oklahoma State Univ., Stillwater.
M. David Rickard, and A. F. Gaudy.
Proceedings, Industrial Wastes Conference, 23rd, May 1968, p 883-893. 6 fig, 23 ref.

Descriptors: *Mixing, *Oxygen requirements, Activated sludge, Biological treatment, Waste water treatment.
Identifiers: *Completely mixed system, *Oxygen tension, *Oxygen uptake, *Sludge yield.

Operation of a completely mixed steady-state reactor at constant agitation (velocity gradient) but varying oxygen tension has shown that oxygen uptake rate and biological solids yield remained relatively constant for the range of DO concentrations between 1.4 and 7.1 mg/l. In addition, no effect was noted on the amount of RNA or protein contained in the cells. Also, as oxygen concentration was increased, there was a slight increase in DNA content of the cells, and a small improvement in both COD and glucose removal efficiency. There was a significant decrease in carbohydrate content of the cells. Concerning oxygen uptake rate, it may be concluded, based upon the present results and the work previously reported, that agitation of the system exerts an effect independent of oxygen tension at values above those accepted for critical DO concentration. (Aguirre-Texas)
W70-08322

INTERRELATIONS BETWEEN BIOLOGICAL AND CHEMICAL CHARACTERISTICS IN ANAEROBIC DIGESTION,
National Inst. for Water Research, Pretoria (South Africa).
P. G. Thiel, D. F. Toerien, W. H. J. Hattingh, J. P. Kotze, and M. L. Siebert.
Water Research, Vol 2, No 4, p 393-408, Apr 1968. 2 fig, 9 tab, 19 ref.

Descriptors: *Anaerobic digestion, *Ecosystems, *Correlation analysis, Laboratory tests, Chemical oxygen demand, Nitrogen, Enzymes, Failures.
Identifiers: *Characteristics, *Linear correlation coefficients, *Volatile acid concentration, Bacterial counts, Gas productions.

The ecosystem of anaerobic digestion including determinations of both biotic and environmental characteristics and the interrelations between these characteristics was investigated. Three 14-liter laboratory-scale digesters were fed a synthetic substrate which contained limiting amounts of nitrogen, COD:N ratio of 135:1. The characteristics of these three digesters were followed daily until failure of digestion occurred as a result of the nitrogen deficiency. A significant increase in volatile acid concentration was taken as digester failure. Digester failure was noted after 12, 17 and 22 days. The daily observations included gas production data, chemical quality determinations, bacterial counts, and the determination of a wide range of intermediary metabolic enzymes. Linear correlation coefficients were determined between all the different characteristics observed. Significant correlations were found between many of the different characteristics. The changes taking place in the characteristics until failure occurred and the implications of some of the correlations found are discussed. (Galwardi-Texas)
W70-08323

ANALYTIC AND PROCESS CLASSIFICATION OF EFFLUENTS,
Connecticut Univ., Storrs.
T. Helfgott, J. V. Hunter, and D. Rickert.
Journal, Sanitary Engineering Division, Proceedings, American Society of Civil Engineers, Vol 96, No SA3, p 779-803, June 1970. 11 fig, 13 tab, 40 ref.

Descriptors: *Waste water treatment, *Classification, *Effluents, Nutrients, Sewage treatment, Activated sludge, Membranes, Adsorption, Activated carbon, Organic chemicals, Electrodialysis, Membrane processes, Amino acids, Filtration, Turbidity.
Identifiers: Fractionation.

A choice of processes and systems to remove specific contaminants from waste water can better be made if chemical constituents and physical interactions of waste waters are better known. The work is directed towards the achievement of higher quality effluents through advanced waste treatment. The results of three separate studies are presented. (1) Analytical description and process classification information on primary, secondary, and advanced waste treatment plant effluents is presented. Data representing the average of 22 different treatment plants are presented with respect to the percentage breakdown of total COD as represented by various organic material. A fairly extensive literature review is presented in regard to organic constituents of sewage. (2) Comparison is made between adsorptivity of soluble organics from sewage and a secondary effluents. Certain organic materials present in effluents are not removed by absorption. On the basis of Total Organic Carbon analyses using dosages of activated carbon, residual organics in effluents are found to range from 2 mg/l to 8 mg/l TOC. (3) A classification technique, gravitational electrodialysis (GED) is presented. The GED method is used to further classify the residual organics of activated carbon treated effluents. Data have been collected to show that the residual organics from high activated carbon dosed effluents contain relatively more soluble cationic material than effluents of secondary and primary treatment. These residual organics of activated carbon treatment appear to be electropositive (cationic) and of high isoelectric value as determined by gravitational electrodialysis fractionation. The sizes are roughly between 10A deg and 100A deg (pL 9-8) and 0.1 (pL6): pL being defined as the negative log of the particle in meters. It is hypothesized that this residual class of organics contain nitrogenous groups that are the degradation products of bacterial cell walls.
W70-08324

DESIGN OF U-TUBE AERATION SYSTEMS,
New Mexico State Univ., Las Cruces.
Richard E. Speece, and Rudolph Orosco.
Journal, Sanitary Engineering Division, Proceedings American Society of Civil Engineers, Vol 96, No SA3, p 715-725, June 1970. 4 fig, 2 tab, 7 ref.

Descriptors: *Aeration, *Design, *Mathematical model, *Oxygenation, Activated sludge, Bubbles, Regretion analysis, Headloss, Sewage treatment, Waste water treatment, Costs.
Identifiers: *U-Tube aeration, Efficiency.

Four independent parameters were studied in the design of U-Tube aeration systems. (1) air-water ratios, (2) inlet dissolved oxygen concentration, (3) depth, and (4) water velocity. Each different combination of parameters will result in different capital and operating costs. Outlet dissolved oxygen concentration is reported in this study for the following ranges of independent parameters. (1) air-water ratio-5 to 25%, (2) inlet dissolved oxygen-0 to 100% saturation, (3) depth-20 to 40 feet, and (4) water velocity-3.6 to 9.2 feet per second. The computer model of the gas transfer equation adapted to U-Tube aerator was used to evaluate the reaeration coefficient k2. Transfer of gases other than oxygen is analyzed. (Hancuff-Texas)
W70-08326

WATER QUALITY: COSTS BENEFITS OF IRREDUCIBLES,
Stone (Ralph) and Co., Inc., Los Angeles, Calif.
Ralph Stone, William Garber, and Helen Friedland.
Journal, Sanitary Engineering Division, Proceedings American Society of Civil Engineers, Vol 96, No SA3, p 691-697, June 1970. 1 fig, 4 tab, 2 ref.

Descriptors: *Costs benefit analysis, *Water resources, *Water quality, Economics, Surveys, Research and development, Statistics, Social aspects, Sewage treatment, Value engineering, Decision making.
Identifiers: *Questionnaire, *Advanced waste treatment, Algorithm.

The ASCE Committee on Sewerage and Sewage Treatment Design designed a questionnaire for distribution to Sanitary Engineering Division membership. The purpose of the questionnaire was twofold: (1) to determine the memberships attitudes and opinions concerning the existing and future social and economic value of alternative beneficial uses of the nation's water resources, and a few general questions relating response to immediate operational experience; (2) to demonstrate an algorithmic technique for quantifying nondeterministic or probabilistic data. Approximately 350 division members (20%) responded. They gave value judgement ratings (range from 1 to 10) for social and economic benefits. The analysis of questionnaires was based on both an algorithmic mathematical formulation and the Delphi method developed by the Rand Corporation. Both concepts were tested and found to support three basic premises: (1) the opinions of a large sample of informed persons have significant value, (2) qualitative judgments can be quantified by use of an abstract scale of relative values, and (3) averaging ranking and normalizing the resulting data provides tools for further information analysis. The study indicated that it is possible to quantify to a degree qualitative information, that sanitary engineers are aware of important social values, and that although existing research and development work is making a significant contribution this technological level can be greatly improved. (Hancuff-Texas)
W70-08328

FILTRATION OF CHLORELLA THROUGH DUNE-SAND,
Technion-Israel Inst. of Tech., Haifa (Israel).
Yair Folkman, and Alberto M. Wachs.
Journal, Sanitary Engineering Division, Proceedings American Society of Civil Engineers, Vol 96, No SA3, p 675-690, June 1970. 15 fig, 2 tab, 18 ref

Descriptors: *Filtration, *Mathematical model, *Chlorella, Groundwater, Headloss, Stabilization, Ponds, Performance, Sewage treatment, Salinity, Effluents, Reclamation
Identifiers: Concentration Efficiency

To study processes occurring when effluents of stabilization ponds are used in artificial groundwater recharge, algae concentration experiments were conducted using a long column filled with dune-sand. A unicellular algae, chlorella, was used varying in size from 3 mu to 5 mu. Under conditions of darkness such as those prevailing in the experimental setup, Chlorella cells divide into smaller dark cells and their size distribution range becomes narrower; consequently, the efficiency of filtration is decreased. For all filtration velocities ranging from 1 to 6 meters per day, the retention of algae occurred mostly in the upper part of the sand column where the increments of headlosses were observed. The hydraulic gradient remained practically constant in the rest of the column. Changes of the relative concentration of algae as a function of depth closely corresponded with the filtration equation proposed by Ives (Proceedings Institution of Civil Engineering 16: 189-193, June 1960), when a coefficient 'b' was introduced to account for algae multiplication. The effect of cation concentration in water on the efficiency of filtration was clearly shown. The addition of cations to filtration water produced significant increases in that efficiency. When lower velocities were used, larger quantities of water could be filtered and the filtration efficiency would be higher. (Hancuff-Texas)
W70-08329

UNIFIED BASIS FOR BIOLOGICAL TREATMENT DESIGN AND OPERATION,
Stanford Univ., Calif.
Alonzo W. Lawrence, and Perry L. McCarty.
Journal, Sanitary Engineering Division, Proceedings American Society of Civil Engineers, Vol 96, No SA3, p 757-778, June 1970. 4 fig, 6 tab, 48 ref.

Descriptors: *Kinetics, *Biological treatment, *Activated sludge, *Anaerobic digestion, *Mathematical models, Growth, Design, Operations, Chemical oxygen demand, Biological oxygen demand, Nitrification, Digestion.

Biological solids retention time (SRT) is related to the performance of continuous biological processes employing suspensions of microorganisms in a fundamental way; therefore, SRT is suggested herein for use as an independent parameter in biological treatment process design and control. Steady-state kinetic models are presented for three process configurations, i.e., completely mixed reactor without solids recycle, completely mixed reactor with solids recycle, and plug flow reactor with solids recycle. Reported values of kinetic coefficients are tabulated for aerobic treatment of organic wastes, for aerobic treatment with nitrification, and for anaerobic treatment of organic wastes. The minimum solids retention time of models are compared with those for actual treatment systems and found to correlate quite well. (Hancuff-Texas)
W70-08330

ENUMERATION, ISOLATION AND IDENTIFICATION OF SULPHATE-REDUCING BACTERIA AN ANAEROBIC DIGESTION,
National Inst. for Water Research, Pretoria (South Africa); and National Inst. for Road Research, Pretoria (South Africa).
D. F. Toerien, P. G. Thiel, and Maria M. Hattingh.
Water Research, Vol 2, No 5, p 505-513, May 1968. 1 fig, 7 tab, 24 ref.

Descriptors: *Anaerobic digestion, *Anaerobic bacteria, *Isolation, *Sulfur bacteria, Sewage sludge, Sewage treatment.
Identifiers: *Desulfovibrio desulfuricans, *Enumeration, Sulphate-reducing bacteria, Ray.

Sulphate-reducing bacteria present in the anaerobic digestion of raw sewage sludge were isolated and enumerated utilizing a method in which anaerobiosis was achieved by the use of media with a low redox potential in stoppered bottles containing oxygen-free gas atmospheres. Carbon dioxide-bicarbonate buffer systems were employed in the media. Seven pure cultures of sulphate-reducing bacteria of the species Desulfovibrio desulfuricans were isolated from digesters being fed raw sewage sludge. No evidence for the presence of sulphate-reducing bacteria of the genus Desulfotomaculum was found. Sulphate-reducing bacteria occurred in numbers of 3-5 x 10 to the 4th power/ml in a raw sewage sludge digester. This low count indicated that these bacteria are not usually a major group in anaerobic digestion. Sulfate-rich water was added to the media and the counts increased to .7-95.0 x 10 to the 6th power/ml. (Galwardi-Texas)
W70-08332

CURRENT TRENDS IN FARM WASTE DISPOSAL,
Ministry of Agriculture, Fisheries and Food, London (England).
C. T. Riley.
Water Pollution Control, Vol 69, No 2, p 174-179, February 1970. 3 tab.

Descriptors: *Animal wastes, *Farm wastes, Cattle, Hogs, Poultry, Odor.
Identifiers: *Manure, *Population equivalents.

Much emphasis has been placed on farm waste disposal in the past five years. Reasons for this include the increased size of livestock units, nearness of units to consumers, recent legislation on river pollution control and water resources, and reaction from the public and farm workers to flies and odor associated with animal wastes. In 1967, the total volume of excreta produced by livestock in the United Kingdom was 121 million tons, with a population equivalent of 136 million. Much of this excreta is spread on the land by ranging animals. The remainder must undergo some form of disposal by man. The wastes can be handled in any of four basic methods. (1) as a solid, it is stored and spread on land once or twice a year. (2) as a semi-solid, it is spread daily. (3) as a slurry, it is handled by vacuum tanker, stored, and spread. (4) as a liquid, it is washed by water to a storage tank and spread by spray irrigation. The trend is toward solid or semi-solid handling. Factors affecting disposal method include land availability, land area, volum of excreta, soil type, crops to be grown, and climatic conditions, especially rainfall. More emphasis is now placed on planning of waste disposal before starting farm projects. Odors can be eliminated by aeration of wastes in the tanker before spreading or spraying on the land. (Makela-Texas)
W70-08333

TREATMENT, USE, AND DISPOSAL OF WASTES FROM MODERN AGRICULTURE,
Water Pollution Research Lab., Stevenage (England).
A. B. Wheatland, and B. J. Borne.
Water Pollution Control, Vol 69, No 2, p 195-208, February 1970. 12 tab, 21 ref.

Descriptors: *Farm wastes, *Animal wastes, *Wastes disposal, *Waste treatment, *Waste water disposal, *Waste water treatment, *Biological treatment, *Sludge disposal, *Sludge treatment, Odor, Aerobic treatment, Incineration, Filtration, Hogs, Cattle, Poultry.
Identifiers: *Manures, *Vegetable washings.

With the trend toward larger concentrations of more animals on smaller areas of land nearer population centers, and the trend of the food industry to require washing and packing of vegetables on the farm, the farmer is faced with new problems in waste and waste water treatment and disposal. Values for quantity of excreta, solids, BOD, COD, PV, organic carbon, and total nitrogen are given for cattle, hogs, sheep, poultry, and man. Recent experimental work on animal waste treatment and disposal is discussed. The problem investigated was odor control during storage and spreading of piggery slurry by means of aeration. Problems which occurred included foaming and bulking of the slurry. The treated supernatant was to be recycled for use in washing the animal pens. Possible future methods of treating animal wastes include incineration, wet oxidation, and disposal at sea. Several analyses of vegetable washing waste waters are presented, giving volumes, pH, solids, BOD, COD, PV. Due to the variable nature of the processes in-

ved in vegetable preparation, the actual degree contamination of the waste water cannot be pre- ted accurately. Treatment includes minimizing quantity of waste water to be treated, and pri- ry, biological and sludge treatment and disposal. mary treatment includes screening and sedimen- ion. Biological treatment can be by lagoons, ated lagoons, oxidation ditches, extended aera- n, conventional activated sludge, contact sta- zation, spray irrigation, biological filtration, or h rate filtration. Sludges can be conditioned, de- tered and disposed at sea or on land. (Makela- xas)
70-08334

E INFLUENCE OF METAL ION CONCEN- ATIONS AND PH VALUE ON THE GROWTH A NITROSOMONAS STRAIN ISOLATED OM ACTIVATED SLUDGE,
ter Pollution Research Lab., Stevenage (En- nd).
E. Loveless, and H. A. Painter.
rnal of General Microbiology, Vol 52, Part 1, p 4, January 1968. 6 fig, 4 tab, 29 ref.

scriptors: *Inhibition, *Activated sludge, owth rates, Nitrification, Toxicity, Hydrogen ion ncentration, *Metals.
ntifiers: *Nitrosomonas, *Optimum values, ure cultures, Michaelis constants.

strain of Nitrosomonas europaea was isolated m activated sludge effluent by a dilution method ich readily demonstrated the presence of con- ninating heterotrophs and yielded a high propor- n of tubes containing pure cultures of ammonia- dizing bacteria. Copper, sodium, calcium and gnesium stimulated growth of pure cultures, and ects of deficiencies of these metals were demon- ated. EDTA improved growth in the basal medi- , and abolished the toxic effect of added copper; was, however, inhibitory at low calcium concen- tions. The effect of pH value on the growth of N. ropaea appeared to be dependent on the metal content of the medium although the optimum value was always between 7.5 and 8. The owth rate constant in pure culture was similar to t previously observed for nitrification in Thames ter, but double that previously observed for rification of sewage by activated sludge. The chaelis constants for ammonia and oxygen bout 1 mgN/l and 0.3 mg/l, respectively) were nilar to those found for nitrification in activated dge. (Aguirre-Texas)
70-08335

IYSIOLOGICAL AND BIOCHEMICAL HARACTERISTICS OF SOME STRAINS OF LPHATE-REDUCING BACTERIA,
tional Physical Lab., Teddington (England); and nois Univ., Urbana.
D. A. Miller, Janet E. Hughes, G. F. Saunders, d L. L. Campbell.
urnal of General Microbiology, Vol 52, Part 1, p 3-179, January 1968. 1 tab, 20 ref.

escriptors: *Classification, *Sulfur bacteria, icro-organisms, Bacteria, Sulfates.
entifiers: *DNA base composition, *Sulfate- ducing bacteria, Biochemical characteristics, esulfotomaculum, Desulfovibrio, Physiological aracteristics.

urteen previously unstudied strains of the genus esulfovibrio and eight thermophilic strains of the nus Desulfotomaculum were allotted to species the results of physiological and biochemical sts. On DNA base composition the Desulfovibrio rains fell clearly into three groups, corresponding Dv. Salexigeris, Dv. desulfuricans and Dv. Vul- ris. NaCl dependence appeared to be a constant d unique feature of Dv. salexigeris strains, and lfate-free' growth on pyruvate a constant aracteristic of Dv. desulfuricans, although one rain of Dv. Vulgaris also dismuted pyruvate. Fu- arate dismutation showed no species correlation. lfate-free' growth on choline was often minimal and the best appeared to be of little value. A high degree of resistance to Hibitane was not a constant characteristic of Dv. salexigeris. The thermophilic strains showed great uniformity in DNA base composition, Hibitane resistance and 'sulfate-free' growth, and were all classified as Desulfotomaculum nigrificans. (Aguirre-Texas)
W70-08336

CLEAN WATER AND ULTIMATE DISPOSAL,
BSP Corp., Brisbane, Calif.
Frank Sebastian, and Robert Sherwood.
Water and Sewage Works; Vol 116, No 8, p 297-300, August 1969. 5 fig, 3 tab, 6 ref.

Descriptors: *Cost comparisons, *Lime, *Sludge treatment, *Sludge disposal, *Costs, *Activated carbon, Phosphates, California.
Identifiers: *Recalcination, *Thermal systems, Lake Tahoe (California).

The unique application of thermal systems for solid waste reclamation and disposal at the South Tahoe Phosphate Removal and Water Reclamation Plant was presented. Three unique thermal processing systems were employed. Bartlet Snow Pacific multiple hearth furnaces were used in the thermal treatment systems. The first system processes a relatively wet dewatered sludge, 15-20 percent total solids, obtained from the addition of lime to raw primary sludge. Elimination of all odors and steam plume was obtained. Lime treatment of the sewerage plant effluent produces another distinct sludge which was centrifuged producing a cake of about 50% moisture. This sludge was recalcined at temperatures approaching 1900 deg F. for eventual recovery of the lime. Dry lime storage was possible without the associated dust problems by the application of a Thermal Disc Cooler. The TDC utilized water as the heat transfer liquid and decreased the temperature of the calcined lime from 1400 deg F to less than 400 deg F. There was virtually no recarbonation as the system was totally enclosed. The third system was used in the regeneration of activated carbon at the cost of $0.023 per lb. (Galwardi-Texas)
W70-08337

SCHOOL AND STATE COOPERATE FOR EFFECTIVE OPERATOR TRAINING,
Clemson Univ., Dept. of Environmental Systems Engineering, and Illinois Univ., Urbana. Dept. of Civil Engineering.
W. N. McLellon, John H. Austin, and J. F. Andrews.
Water and Sewage Works, Vol 116, No 2, p 46-49, February 1969. 2 ref.

Descriptors: *Education, *Training, Municipal wastes, Municipal water, Industrial wastes, Industrial water, Permits.
Identifiers: *Treatment plant operators, *Certification, *Manuals.

A great need exists for upgrading existing water and waste water treatment plant operator staffs both in quantity and quality. A progressive training program was instituted in the state of South Carolina in 1952 through the efforts of the South Carolina Water and Pollution Control Association and Clemson University. This program consisted of a series of correspondence courses extending through four levels of operator training. In addition, annual three-day short courses are held at Clemson followed by a certification examination. In 1966, South Carolina passed a law requiring mandatory certification of public water treatment plant operators. A similar law is expected for waste water treatment plant operator certification. Beginning in 1969, the faculty of Clemson University and the University of Illinois began a complete updating and improving of all correspondence course manuals. This set of manuals should serve as a very important tool in operator training programs. (Makela-Texas)
W70-08338

THE DECOMPOSITION OF ALIPHATIC ESTERS BY AEROBIC MICROORGANISMS,
Texas A and M Univ., College Station.
W. D. Langley, W. B. Davis, and P. A. Richards.
Proceedings Industrial Waste Conference, 23rd, p 229-241, May 1968. 7 fig, 3 tab, 12 ref. OWRR A-003-TEX, FWPCA 5T1-WP74.

Descriptors: *Biodegradation, *Cultures, *Gas chromatography, *Hydrolysis, Activated sludge, Alcohols, Byproducts, Metabolism, Oxidation.
Identifiers: *Removal rates, Esters, Substrates.

The removal of the acetate esters of C2-C6 normal alcohols has been observed in aerobic cultures of mixed population using direct injection aqueous gas chromatography as the analytical technique. The substrate-culture interaction results in the rapid hydrolysis of the ester with the appearance of the alcohol product in the aqueous phase providing its subsequent removal and oxidation is slower than the hydrolysis reaction. On a molar concentration basis, the rates of hydrolysis of the esters are virtually equal as are the rates of alcohol disappearance. In an aerated biological system, air stripping will compete with hydrolysis as a mechanism for ester removal and may constitute a significant factor in total removal. The lower molecular weight normal alcohols are relatively resistant to air stripping and will be removed primarily by biochemical mechanism. Removal rates for esters ranged from 530 to 879 mg/hr/g MLSS for ethyl acetate through n-hexyl acetate. Removal rates for alcohols ranged from 19.5 to 37.2 mg/hr/g MLSS for ethanol to 1-hexanol. (Aquirre-Texas)
W70-08340

FORMATION AND FINAL COMPOSITION OF THE BACTERIAL FLORA OF A DIARY WASTE ACTIVATED SLUDGE,
Agricultural Univ., Wageningen (Netherlands).
A. D. Adamse.
Water Research, Vol 2, p 665-671, 1968. 1 fig, 4 tab, 12 ref.

Descriptors: *Activated sludge, *Bacteria, *Dairy industry, Biological treatment, Laboratory tests, Microbiology, Milk, Waste water treatment.
Identifiers: *Coryneform bacteria, Flora, Oxidation ditch.

A comparison of the bacterial flora of a dairy waste activated sludge developing from the initial to the optimal stage in an oxidation ditch and in a laboratory apparatus, showed a close similarity between both systems, so that the latter may be used for representative experiments. Adaptation of the bacterial flora to the supplied waste was found to be a slow process. The composition of the flora altered with time until ultimately it consisted predominantly of caryneform (Arthrobacter-like) bacteria. Next to these, considerable amounts of Achromobacteraceae were found. Pseudomondaceae, initially present in large numbers, decreased to the 1 east important of the 3 major groups of bacteria. The alteration of the bacterial groups coincided with an alteration of the physiological characteristics of the total activated sludge flora. In the final stage two-thirds of the isolated bacteria gave a neutral reaction on Hugh and Leifson media and more than half were non-proteolytic. This is an agreement with the predominant position held by the group of conyneform-particularly Arthrobacter-like bacteria. The brown color of dairy waste activated sludge may be attributed to Flavobacteria. (Aguirre-Texas)
W70-08387

INFLUENCE OF SHAPE ON MIXING AND LOAD OF SEWAGE LAGOONS,
Mississippi State Univ., State College. Dept. of Civil Engineering.
Adnan Shindala, and William C. Murphy.
Water and Sewage Works, Vol 116, No 10, p 391-394, October 1969. 9 fig, 7 ref.

Descriptors: *Distribution patterns, *Mixing, *Organic loading, *Performance, *Sewage lagoons, *Shape, Waste water treatment.

Identifiers: *Influence.

The performance of sewage lagoons depends primarily on biological processes, and any factors which influence performance must necessarily be related to the biological environment of a lagoon. The most important factors which must be considered in the design and performance of an efficient lagoon are: temperature, light, organic loading, geometry, and hydraulic appurtenances. The amount of natural mixing and load distribution can be enhanced by proper selection of the size and shape of a lagoon and the location of inlets. This study presents the results of prototype experiments of various shaped lagoons. The data obtained indicate that load distribution in a sewage lagoon is influenced by the lagoon's shape. When comparing the distribution of the parameters in the entire lagoons, the rectangular lagoon showed a more uniform load distribution than its counterpart. (Aquirre-Texas)
W70-08388

EFFECTS OF PESTICIDES ON RAW WASTE WATER,
Tulane Univ., New Orleans, La. Dept. of Civil Engineering.
L. W. Canter, D. D. Nance, and D. R. Rowe.
Water and Sewage Works, Vol 116, No 6, p 230-234, June 1969. 5 fig, 4 tab, 3 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, Water pollution, Effects, *Pesticides, *Waste water treatment, Biological treatment, Dieldrin, Endrin, *Oxygen demand, Pesticide toxicity, *Bacteria, Biochemical oxygen demand, Toxicity.

The effect of commerical chlorinated hydrocarbon pesticide products on the oxygen demand of waste water and on growth characteristics of bacteria was examined. To evaluate the effect of commerical pesticide products on the oxygen demand of waste water, the BOD and COD tests were utilized. The toxic effect on the growth of bacteria was ascertained from the BOD results and from special bacterial growth studies using E. coli. In the range of 0-2 mg/l of dieldrin, the commerical dieldrin product caused an average increase in BOD of 130 mg/l for each mg/l increase in pesticide concentration. In the range of 0-5 mg/l of endrin, the commercial endrin product caused an average increase in BOD of 40 mg/l for each mg/l increase in pesticide concentration. In the range of 0-2 mg/l of equal pesticide mixtures, the average increase was 80 mg/l for each mg/l increase in the pesticide mixture. Concentrations of pure endrin up to 50 mg/l exhibited no additive effect to the BOD. The organisms were capable of surviving and growing for 24 hours in commercial pesticide concentrations up to 500 mg/l. The low solubility of dieldrin and endrin apparently inhibited the toxic action of these pesticides on bacteria. This inhibition was due to the unavailability of these pesticides for direct contact with the bacteria. (Aguirre-Texas)
W70-08389

ORGANICS REMOVAL BY A SELECTED TRICKLING FILTER MEDIA,
Texas Univ., Austin. Center for Research in Water Resources.
S. Balakrishnan, Wesley W. Eckenfelder, and C. Brown
Water and Wastes Engineering, Vol 6, No 1, p A22-A25, January 1969. 4 fig, 2 tab, 14 ref.

Descriptors: *Biological treatment, *Efficiencies, *Filtration, *Organic wastes, *Trickling filters, Biochemical oxygen demand, Retention, Waste water treatment
Identifiers: *Plastic media, Total organic carbon.

Organics removal characteristics of 1 1/2 inch polypropylene flexirings were evaluated. Mean residence times were determined in tracer studies using sodium chloride. Settled domestic sewage was treated in an 8 foot pilot plant trickking filter, and the organic removal characteristics in terms of BOD and TOC were measured. A correlation was developed between the specific surface of the media, applied BOD concentration, and the removal rate coefficient. Based on this correlation, it may be said that the flexiring media exhibits a removal rate of the same order of magnitude as other media having the same specific surface in terms of organics removal. Residence times studies showed that the mean residence time of a waste water through a bed of loosely packed, nonporous media was inversely proportional to the 0.45 power of the hydraulic loading rate for the media with slime. The residence time of the waste water in the medium with slime was about 5 to 6 times as large as that in a clean medium. The TOC and BOD of the feed ranged from 15.5 to 45.5 and 65 to 90 mg/l respectively. The average percent TOC removals through 8 foot depth of filter for hydraulic loadings of 12.5, 18.8 and 27 mgd per acre were respectively 57, 53, and 46. For the same conditions, the average BOD removals were respectively 66, 62, and 57%. (Aguirre-Texas)
W70-08390

THE SURFACE OF ACTIVATED SLUDGE PARTICLES IN RELATION TO THEIR SETTLING CHARACTERISTICS,
University Coll. of South Wales and Monmouthshire, Cardiff. Dept. of Microbiology.
C. F. Forster.
Water Research, Vol 2, p 767-776, 1968. 8 fig, 2 tab, 27 ref.

Descriptors: *Activated sludge, *Dewatering, *Electrophoresis, *Settling velocity, *Sludge, *Surfaces, Zeta potential, Waste water treatment, Sewage.
Identifiers: Electrokinetic properties.

The relationships of the surface properties of sewage sludges to their dewatering characteristics are reported. The measurement of the electrophoretic mobility of activated sludge particles was therefore included in the analysis of routine samples from a Lubeck pilot-plant. In constant ionic strength buffer solutions (I=0.2) no correlation was found between either the iso-electric points or the pK values of the sludge surfaces and the sludge volume index. Mobility measurements of the sludge particles in their own liquors, however, showed that the average mobility was directly proportional to the sludge volume index which in turn was a logarithmic function of the ratio of ammonia-nitrogen to soluble phosphate in the liquors. This would appear to indicate that the settling characteristics of activated sludges are governed by some metabolic process which can alter the nature of the surface of the sludge particles. (Aquirre-Texas)
W70-08391

BIOLOGICAL PARAMETERS FOR THE OPERATION AND CONTROL OF OXIDATION PONDS-II,
Department of Industries, Cape Town (South Africa). Div. of Sea Fisheries.
U. S. Tschortner.
Water Research, Vol 2, p 327-346, 1968. 9 fig, 7 tab, 24 ref.

Descriptors: *Algae, *Biological properties, Control, *Operation and maintenance, *Oxidation lagoons, Absorption, Biodegradation, Chemical oxygen demand, Chlorophyll, Lagoons, Ponds, Oxidation, Waste water treatment.

Oxidation ponds are an economical means of treatment for domestic sewage and industrial waste effluents, and are widely used in the less populated areas of warmer climates. Their action resembles the natural purification process of polluted river. They require less attention and skilled staff than mechanical systems. The successful performance of stabilization, however, depends on the biological balance of the system. The present study describes the development of parameters for the determination of the oxygen-producing community (parameters A and AP) and the efficiency of the pond on the breaking down of the load (parameter E). Parameter A reveals the relative fraction of chlorophyll-bearing organisms of the total load and allows a direct measurement of autotrophic pond performance. Parameter AP reveals the rate of photosynthesis and does not depend on variations of chlorophyll-a content of cells. Parameter E is based on the metabolism of algae and crustaceous; it estimates the contribution of both to the micropopulation and indicates the effectiveness of algae in removing pollution. Comparison of the COD contributed by dissolved and suspended solids, with the calculated values for algae and non-algal matter of the suspended fraction, revealed that in a well-balanced system more than half of the total COD is contributed by algal cells, the figure in the overloaded ponds being only 20%. (Aguirre-Texas)
W70-08392

KINETICS OF HYDROGEN ASSIMILATION IN THE METHANE FERMENTATION,
Engineering-Science, Inc., Oakland, Calif.
T. G. Shea, W. A. Pretorius, R. O. Cole, and E. A. Pearson.
Water Research, Vol 2, p 833-848, 1968. 5 fig, 6 tab, 5 ref.

Descriptors: *Fermentation, *Hydrogen, *Kinetics, *Methane, Bacteria, Anaerobic bacteria, Anaerobic digestion, Growth rates, Laboratory tests, Mathematical models, Waste water treatment.
Identifiers: Methano bacterium formicicum, Michaelis-Menten model.

The fermentation of methane from hydrogen and carbon dioxide has received considerably less biological engineering research emphasis than has methane fermentation of organic (volatile) acids, particularly acetic and propionic acids. As an initial step in determining the significance of methane production from hydrogen, this investigation was undertaken to evaluate the growth and kinetic characteristics of a species of the methane bacteria which ferment hydrogen in continuous culture. The generation time of the bacteria in the hydrogen enrichment fermentation was found to be 15.6 hours (hydrogen COD basis) and 13.2 hours (total COD basis); which is about one-third to one-fourth those described for methane bacteria by McCarty et al. Under the normal conditions of anaerobic fermentation of sewage sludge, hydrogen is generally less than 3% of the product gases. The saturation constants of hydrogen in the enrichment culture systems were found to be 569 and 724 mm Hg or 75 and 95% hydrogen based respectively on hydrogen and total COD removals. The results of the growth and kinetic study indicate that a continuous flow enrichment culture, predominant in hydrogen assimilating methane bacteria can be characterized well by the Michaelis-Menton model. Although the methane bacteria which ferment hydrogen are capable of high substrate conversion rates, the rate of hydrogen assimulation by these bacteria in a normal sludge digestion is computed to be less than 3% of the total methane production based on the Michaelis-Menten equation and the laboratory-determined constants. (Aguirre-Texas)
W70-08394

REMOVAL OF SUGARS BY ACTIVATED SLUDGE,
Water Pollution Research Lab., Stevenage (England).
H. A. Painter, R. S. Denton, and C. Quarmby.
Water Research, Vol 2, p 427-447, 1968. 7 fig, 9 tab, 27 ref.

Descriptors: *Activated sludge, *Biodegradation, *Organic wastes, Oxidation, Oxygen demand, Sewage, Waste water treatment.
Identifiers: *Sugars, Poly-beta-hydroxybutyric acid.

Conditions are described for affecting the ability of sludges, grown for the most part on sewage, to remove glucose, sucrose, and fructose, the most

ommon sugars found in domestic sewage. Sugars ere chosen for study since they comprise the ajor part of the soluble organic carbon present in omestic and other sewages. The sugars normally resent in sewage were removed from solution by ctivated sludge at much the same rate as was dded glucose (40-50 mg/l/hr). The Michaelis con-ants for sugars were in the region of 10 mg/l at 20 eg C. A simple relation was not found between OD loading and the ability of a sludge to remove ugars, but in general the higher the 'sugar loading' e greater the activity of the sludge. At the point f complete or near complete removal of sugar om solution, variable proportions of the theoreti-al amounts of oxygen were taken up, namely 10-0% for glucose and 8-26% for sucrose. No vidence of formation of significant amounts of oly-beta-hydroxybutyric acid was found in ac-vated sludge grown on sewage receiving normal nounts of glucose, though the presence of 0.5% olymer in sludge was established. It was con-uded that biochemical removal of soluble sub-rates is not a limiting factor in the activated-udge process, so that any limitation on the load pplied would appear to involve flocculation or eparation of sludge particles. (Aquirre-Texas)
/70-08395

ELF-PURIFICATION IN AN OPEN DITCH,
ppsala Univ. (Sweden). Inst. of Limnology.
ils Brink.
/ater Research, Vol 2, p 481-503, 1968. 19 fig, 5 ab, 19 ref.

escriptors: *Open channels, *Self-purification, Sewage, Flocculation, Organic matter, Pollution, batement, Sedimentation, Waste water treat-ent.

he self-purification of running water after pollu-on by sewage was studied in a ditch with a small ater depth. Both during winter (0-1 deg C) and mmer a high degree of self-purification with espect both to organic matter, nutrient salts and acteria was observed within a distance of 200-300 eters and during a time less than 4.5 hour. Floc-ulation and sedimentation of organic and inor-anic substances were the predominant processes, specially in winter, but also ordinary breakdown nd building-up of organic matter and nitrification ook place. At high flow in spring and autumn, eposited bottom sludge was carried away by the ream. Such an oxidation ditch, without disturbing rainage water from the surroundings during high ow, is well suited as an alternative method of eating sewage. A drop of up to about 90% in or-anic matter, nitrogen, and phosphorus over a istance of less than 300 meters was observed in inter and summer. The same was the case with oliform and general heterotrophic bacteria to near 00%. In spring and autumn no such decreases oc-urred. An oxygen sag was found during winter and mmer. A balance between oxygen and BOD5 was eached after 350 m. In spring and autumn no sag as found. (Aguirre-Texas)
/70-08396

HE BIOLOGY OF SPHAEROTILUS SPECIES,
eorgia Univ., Sapelo Island. Marine Inst.
ohn D. Phaup.
/ater Research, Vol 2, p 597-614, 1968. 5 fig, 2 ab, 49 ref.

escriptors: Bacteria, Biology, *Sphaerotilus, Cytological studies, Nutrients, Waste water treat-ent, *Systematics, *Plant morphology.

iterature is reviewed and summarized pertaining o the taxonomy, morphology, cytology and nutri-on of members of the bacterial genus Sphaerotilus nd present limited unpublished data. Sphaerotilus an aerobe, although its oxygen requirements are eager. The optimum temperature is 15-30 deg C nd optimum pH near neutrality, although growth ccurs over a wide range of both. The genus phaerotilus consists of two valid species, S. natans utzing, S. discophorus Pringsheim, and possibly a third minute form which may be a subspecies of S. natans. Sphaerotilus spp. utilize a variety of organic acids, sugars and alcohols as carbon and energy sources. Glucose, however, represses synthesis of some enzymes in S. discophosus. Calcium and magnesium are necessary for growth. Iron and phosphates may be required in trace quantities but are toxic in low concentrations. Autotrophy remains to be proven in the genus. (Aquirre-Texas)
W70-08397

NEW WEST WINDSOR SEWAGE PLANT HAS MANY NOVEL FEATURES,
Grunwell Associates Ltd., Clarkson (Ontario).
Harry Grunwell.
Water and Pollution Control, Vol 108, No 5, p 20-21, 36, May 1970. 2 fig, 1 tab.

Descriptors: *Waste water treatment, *Treatment facilities, *Chlorination, Power system, Flow meters, Sludge disposal, Sludge treatment, *Sewage treatment.
Identifiers: Vortex grit removal, Windsor, Ontario (Canada).

The West Windsor Sewage Treatment Plant is an automated primary sewage treatment plant of 24 mgd, expandable to 60 mgd with secondary treatment. The capital costs for primary treatment, sludge removal and pumping totalled 7 million dollars. The plant contains several novel features: flow metering, vortex grit removal, dosage controlled chlorination, co-ordinated sludge dewatering system, closed circuit television, load sharing stand-by power sources, contract management by separate contract. The flow metering system consists of 2 flange mounted, propellor type flow meters with bearing purge systems. The accuracy of these meters over the range of pumping expected to apply, will be within plus of minus 2-3%. Grit removal is accomplished by using two, 15 ft. diameter aerated Vortex tanks using air lift grit removal. A chlorine residual recorder system is used to control chlorination. An automatic transfer system capable of providing stand-by power within 30 seconds of power failure has been installed. Two 1800 HP/1200 KW diesel generator sets are available to supply stand-by power. The use of thickening sections in the center bottoms of primary settling tanks, an automated pumping and vacuum filtration system and storage hoppers for cake storage prior to trucking are the main features of a co-ordinated sludge removal system. (Galwardi-Texas)
W70-08398

WILMINGTON GOES ON LINE WITH MODERN NEW SECONDARY TREATMENT PLANT.

Water and Sewage Works, Vol 116, No 12, p 471-473, December 1969. 6 fig.

Descriptors: *Waste water treatment, *Treatment facilities, *Air demand, *Performance, *Design criteria, Activated sludge, Biochemical oxygen demand, Costs, Delaware.
Identifiers: *Air supply blowers, Wilmington (Delaware).

Completion of a $4 million secondary sewage treatment facility allows Wilmington, Delaware to meet federal regulations governing water pollution. The treatment facility serves a population of 500,000 persons with a combined industrial and domestic flow of 60 mgd in 1968. The secondary treatment plant consists of two aeration tanks, each 14,400 sq ft. with a combined capacity of 3,230,000 gal and two final clarifiers with a combined capacity of 3,750,000 gal. Four rotary positive blowers provide a flexible supply of air to the aeration tanks. Two blowers are equipped with constant speed 250 hp motors and two with variable speed 250 hp motors. The BOD removal is approximately 55% for both primary and secondary plants. (Galwardi-Texas)
W70-08399

WET AIR OXIDATION AT LEVITTOWN,
Lower Bucks County Joint Municipal Authority, Pa.
Paul X. Blattler.
Water and Sewage Works, Vol 117, No 2, p 32-34, February 1970. 3 fig, 4 tab.

Descriptors: *Sludge disposal, *Treatment facilities, Performance, *Sludge treatment, *Oxidation, *Operating costs, *Capital costs, Vacuum drying, Temperature, Waste water treatment, Pennsylvania.
Identifiers: Wet oxidation, Low pressure oxidation, Levittown (Pennsylvania).

Levittown, Pennsylvania has solved its sludge disposal problem with the installation of a low pressure oxidation unit which provides wet oxidation of its raw and digested sludge. Sludge is pumped to the process at a pressure of approximately 300 psi and is passed through a heat exchanger and heated to a temperature of 300 deg F by the outgoing oxidized sludge before entering the reactor. A reactor outlet temperature of 340-350 deg F is obtained either from heat given off by the oxidation or by steam injected into the system. Odors are completely removed by passing the gases through a catalytic combustion unit at temperatures of 650-750 deg F. The oxidized sludge is then vacuum filtered without chemical additives. Typical sludge characteristics, operating performance and filtration data are presented in tabular form. Capital costs were approximately $200,000 and operating costs were itemized. An operating cost of $11.10 per ton of dry solids at an operating rate of 3.65 tons per day is reported. (Galwardi-Texas)
W70-08400

SOLIDS DON'T GO TO WASTE AT WYETH,
Wyeth Labs., Philadelphia, Pa.
John A. Moffett.
Water and Sewage Works, Vol 117, No 3, p 4-5, March 1970. 5 fig.

Descriptors: *Waste water treatment, *Pre-treatment, Centrifugation, Performance, Activated sludge, Treatment facilities, Sludge treatment, Sludge disposal, Biochemical oxygen demand, Pennsylvania, *Solid wastes.
Identifiers: Westchester (Pennsylvania).

Pretreatment of 140,000 gpd is provided by Wyeth Laboratories before discharge into Westchester's sanitation plant. The treatment facilities consist of an equalization tank, activated sludge aeration units and clarifiers with heli-thickeners, and a centrifuge. Before installation of the centrifuge, excess solids either had to be raked off from the surface of the aeration tanks, or simply ended up in the plant's effluent. BOD removal of 90-95% is provided by the plant. The centrifuge provides a solids handling system and also regulates the solids content of the aeration tanks. A model P-3400 Sharples centrifuge is used for a period of one week in every 3 months. Input conditions to the centrifuge range from 24 to 31% suspended solids, by volume, with a 15 to 20 gpm feed rate. The solids content of the liquid effluent has been reduced to 0.5 to 7.0% and the moisture content of the cake is 95 to 96%. (Galwardi-Texas)
W70-08401

CANADA'S LARGEST SLUDGE INCINERATORS FIRED UP AND RUNNING.
Department of Works, Toronto (Ontario).

Water and Pollution Control, Vol 107, No 1, p 20-24, January 1969. 4 fig, 1 tab.

Descriptors: *Sludge treatment, *Sludge disposal, *Costs, *Incineration, Performance, Air pollution, Waste water treatment.
Identifiers: Multiple hearth furnaces, Air pollution control, Toronto (Canada).

Three multi-hearth sewage sludge incinerators rated at a combined capacity of 134 dry tons per

day were installed at the Main Treatment Plant at Ashbridges Bay in Toronto. The multiple-hearth furnaces are cylindrical, refractory-lined steel shells containing a series of horizontal refractory hearths located one above the other. Combustion takes place in an enclosed environment as the furnace is divided into three distinct zones of drying, combustion and cooling. Combustion temperatures are between 1400 and 1600 deg F. The loading rate in lbs/hr of filter cake to each furnace can reach 23,900 based on a moisture content of 80%. Residual inorganic ash is pumped as a slurry to a near-by lagoon. Tests of the liquid overflow show that it has a BOD of only 2 to 3 ppm. Each incinerator is equipped with a flue-gas scrubber system. This complies to a code which calls for a discharge of not more than 0.30 lb of dust per 1000 pounds of gas adjusted to 12% CO2. The incinerators were installed at a total contract price of 3.8 million dollars. (Galwardi-Texas)
W70-08402

THE NON-CHEMISTRY OF CHEMICAL TREATMENT,
McMaster Univ., Hamilton (Ontario). Dept. of Chemical Engineering.
Jack Norman.
Water and Pollution Control, Vol 107, No 3, p 18-20, March 1969. 1 fig.

Descriptors: *Water treatment, *Waste water treatment, *Chemistry, Chemical precipitation, Coagulation, Hydrogen ion concentration, Disinfection, Water softening, Chemical reactions.

Chemical treatment is practiced in almost all water and waste water treatment plants, yet its action is neither predictable nor understood in many cases. A review of various categories of attitudes that exist toward chemical treatment of water and waste water is presented. The measure of success that is used in evaluating the usefulness of some particular chemical in producing reactions in water and the lack of knowledge and lack of understanding of the chemical reaction processes occurring during the use of these chemicals are pointed out for four applications. The applications covered are the coagulation, disinfection, water softening and pH control processes. (Galwardi-Texas)
W70-08403

CONTACT STABILIZATION PROCESS CHOSEN FOR NEW DYRDEN PLANT.
Water and Pollution Control, Vol 107, No 4, p 32-33, April 1969. 2 fig.

Descriptors: *Waste water treatment, *Facilities, *Costs, *Capitol costs, Sewers, *Domestic wastes, *Municipal wastes.
Identifiers: *Contact stabilization process, Dryden, Ontario (Canada).

The contact stabilization process was chosen for the Dryden, Ontario, waste water treatment plant because the waste was predominantly domestic sewage. The plant was designed for a daily capacity of 1 mgd and a maximum capacity of 2.5 mgd with a 90% removal rate. The plant consists of a 30-foot pump station, a 10-foot diameter Dorr-Oliver-Long detritor unit, and 18-inch Chicago Pump Model C barminutor, two 500,000 gpd Smith and Lovless Oxigest biological treatment units, and a 12-foot by 30-foot chlorine contact chamber. The contact stabilization process has the two-fold advantage of reducing the size of the biological treatment units, and reducing the cost of the installation. The use of steel tanks for the biological treatment units reflected the high cost of concrete work in Northern Ontario. The total cost of the project was $1.3 million, with the trunk collector sewers costing $675,000, the pumping station $85,000 and the treatment plant $553,000. (Galwardi-Texas)
W70-08404

OZONE TREATS WASTESTREAMS FROM POLYMER PLANT,
Texas Univ., Austin. Dept. of Civil Engineering.
William W. Kwie.
Water and Sewage Works, Vol 116, No 2, February 1969, p 74-78. 3 fig, 2 tab, 15 ref.

Descriptors: *Ozone, *Organic wastes, *Biodegradation, *Waste water treatment, Oxidation, Effluent streams.
Identifiers: *Unsaturated organics, Sodium alkyl napthalene sulfonate, *Polymer plants, Waste streams.

Ozone is used to treat three separate waste streams from a polymer plant, each of which is normally resistant to biodegradation. The first stream is extremely high in chlorides, the second contains unsaturated organic compounds, and the third contains both unsaturated organic compounds and solium 8-alkyl naphthalene sulfonate-2 (SANS). The ozone reacts readily with the unsaturated organics and the naphthalene moiety of SANS. A dosage of 5400 mg/l ozone in the first stream resulted in a COD reduction of 90%. Although the naphthalene moiety of the SANS is removed by ozonation, the resulting compound proved to be no more adaptable to biodegradation than the untreated SANS. It is speculated that a culture of specially acclimated microorganisms might be developed to treat the SANS fraction. (Makela-Texas)
W70-08407

ORGANIC COMPOUNDS REMOVED BY REVERSE OSMOSIS,
Washington State Univ., Pullman. Dept. of Sanitary Engineering.
Ervin Hindin, Paul J. Bennett, and Shyamela S. Narayanan.
Water and Sewage Works, Vol 116, No 12, p 466-470, December 1969. 4 tab, 14 ref.

Descriptors: *Reverse Osmosis, *Membrane processes, *Organic compounds, Tertiary treatment, *Pesticide removal, Oil wastes, Waste water treatment, DDT, Alkylbenzene sulfonates, Linear alkylate sulfonates, *Sulfonates.
Identifiers: *Cellulose acetate membranes, Lindane, TDE (DDD).

The permeation of over 30 specific chemical species through a laboratory-scale reverse osmosis unit employing cellulose acetate membranes was determined. Chemical species investigated were those most commonly found in treated waste water effluents. Initially, the individual species in an aqueous solution or dispersion was investigated and then mistures were investigated to determine the presence of synergistic or antagonistic actions of one species toward another. Reductions of 80 to 99% were obtained for those chemical species existing primarily in the colloidal, aggregate, unicell or macromolecular form. When the species was partially in true solution and when the vapor pressure of the discrete molecule in true solution was appreciably greater than that of water, reductions of 50 to 80% were obtained. When the discrete molecules were more volatile than water, reductions were between 14 and 40%. Typical reductions for selected single chemical species are: ABS-94.0%; LAS-97.2%, Motor oil>99.7%; DDT>97.3%; Cellulose-61%; Acetone-47%. Mixtures of most of these species showed marked reductions in these results due to antagonistic as well as synergistic effects at the membrane surface. Finally secondary treatment plant effluents were applied to the system and when specific species were not present, they were added. Comparison of these results with those from single species and mixture studies indicated more effective removals were obtained for most all compounds. (Sorber-Texas)
W70-08408

CHEMICAL FEED SYSTEMS DETERMINE PLANT EFFICIENCY AND RELIABILITY,
Wallace and Tiernan, Inc., Belleville, N.J.
Robert J. Baker.
Water and Sewage Works, Vol 116, No 6, p 214-217, June 1969. 1 fig.

Descriptors: *Waste water treatment, *Design, Equipment, *Chemicals, *Flexibility control systems, Instrumentation, Storage capacity.
Identifiers: *Chemical feed systems, Capacity.

The application, design, and control of chemical feed systems for water treatment plants is considered. The typical chemical feed system is defined as consisting of chemical storage, preparation for feeding, feeding, preparation for application, application to the process, and related process and system controls. Each of these basic elements is discussed in regards to its importance and position within the chemical feed system. In the design of a chemical feed system seven factors are suggested for consideration: chemical selection, capacity, type of control, flexibility, future requirements, standby equipment and the need for instrumentation. Advance planning for alternatives can provide flexibility for the most suitable chemical for the process and the most economical plant operating costs. Further, variation or changes in process operation can be best accommodated if chemical alternatives are considered during design. Capacity is discussed from two view points: storage and equipment metering ranges both of which can have considerable bearing on the flexibility and workability of the system as a whole. Manual, flow proportional, and feedback from process controls are discussed. Combinations of these on the compound-loop control system is suggested to be the more flexible under most conditions. Overall system flexibility is obtained by selecting equipment with a maximum of alternate uses. This type design will be readily adaptable to future requirements as well as satisfy some requirements for standby equipment. (Sorber-Texas)
W70-08409

A SUGGESTED FORMULA FOR THE PROCESS OF BIOLOGICAL FILTRATION,
Water Pollution Research Lab., Stevenage (England).
R. Lamb, and S. G. H. Owen.
Water Pollution Control, Vol 69, p 209-220, 1970. 14 fig, 9 tab, 14 ref.

Descriptors: *Formulation, *Mathematical models, *Trickling filters, Biodegradation, Design, Filters, Hydraulic properties, Kinetics, Organic loading, Temperature, *Biological treatment.
Identifiers: *Biological filtration, Specific surface area.

An equation has been developed from theoretical considerations which relates the strength of the influent and effluent of a biological filter to the flow of sewage, volume of medium, the specific surface area of the medium, and the temperature of the sewage. Good agreement with the equation has been found with various published data from both England and the USA using both conventional and plastic media. It is hoped that the formula: (BOD sub E)/ ((BOD sub 1)- (BOD sub E)) - F x 0.039e exp. (-0.09 (T-15))/VS has been proved sufficiently to be accepted as the basic equation for biological filtration. It is suggested that for design, a minimum temperature of 8 deg C be assumed. When this is substituted in the right-hand side of the equation the latter becomes F x 0.078/VS. Also the constants have been derived from average values and it is recommended that when designing a filter to produce an effluent always having a BOD of less than 20 mg/l that calculations be made using a BOD sub E of 15 mg/l. This will be produced during all seasons of the year. (Aguirre-Texas)
W70-08410

OHIO TOWN GETS SEWERAGE SYSTEM AFTER 20 YEARS.

Water and Sewage Works, Vol 116, No 6, p 218-221, June 1969. 5 fig.

Descriptors: *Financing, *Lagoons, *Sewerage, *Waste water treatment, Ohio.
Identifiers: Economic Development Administration, *Middleport (Ohio).

er 20 years of struggle, Middleport, Ohio, finally its sewerage system, thanks to the help from eral financing, mostly the Economic Develop- nt Administration. Without this financial aid, lding the system would have been impossible. 6 years, from 1950-1956, Middleport obtained month dumping permits on the grounds that: it might be possible to build a cheaper system combining with adjacent Pomeroy and using the ie treatment plant; (b) the project was too tly for Middleport and there were no federal ds available, (c) there was no need for the tem. On December 2, 1964, the Department of alth, Education and Welfare offered a grant of 8,860 under WPC-Ohio 250. Council approved eneral financing plan in 1965 calling for the is- nce of $515,000 in mortgage revenue bonds. On ruary 9, 1967, EDA grants were received for 4,000 and $66,400. Lagoons were selected as least costly treatment scheme. The system was ned on September 7, 1968. (Aguirre-Texas)
0-08411

CENT STUDIES OF HIGH-RATE BIOLOGI- L FILTRATION,
ter Pollution Research Lab., Stevenage (En- nd).
M. Bruce, and J. C. Merkens.
ter Pollution Control, Vol 69, p 113-148, 1970. ig, 12 tab, 49 ref.

scriptors: Flow rates, Organic loading, *Trick- filters, Biodegradation, Filters, Waste water atment, *Biological treatment, Sewage treat- nt.
ntifiers: *Biological filtration.

estigation was made of performance of a tower er, 7.1 m deep, containing Surfpac medium, en treating domestic sewage at high rates. sults showed that the average BOD removals ieved at hydraulic loadings between 6 and 18 m)/ (sq m)d were very similar to those obtained earlier studies with a filter of 2.1 m depth. The ximum rate of BOD removal was about 1.5 Kg/ m)d. An experiment to determine lateral dis- ution of liquid within the tower indicated that even surface distribution is probably more im- tant in order to achieve full utilization of the dium than is the actual rate of application. sults from a study to compare the efficiencies of ious types of media for high-rate treatment of nestic sewage, indicate that performance is re- d in a general way to specific surface area of the dium but the actual physical configuration of medium also influences performance. The rage performances of the various filters, in ms of BOD removals, were closely related to uid retention time characteristics. BOD removal iciencies ranged from 32.8 to 77.5% for the vari- filters. (Aguirre-Texas)
0-08412

E IMPORTANCE OF ZETA POTENTIAL TO E WATER INDUSTRY,
iversidad Nacional Autonoma de Mexico, Mex- City. Instituto de Geofisica.
ul A. Deju.
ter and Sewage Works, Vol 116, No 12, p 460- 4, Dec 1969. 6 fig, 1 tab, 21 ref.

scriptors: *Zeta potential, *Waste treatment, aste water treatment, *Instrumentation, *Elec- phoresis, Colloids, Industrial wastes.
ntifiers: *Electrophoretic mobility, Moving- undary cell, Mass-transport cell, Microelec- phoresis.

e theoretical considerations and applications of a potential to the water and waste water industry discussed. Zeta potential is defined as the arge of a particle at the periphery of its Stern er and for aqueous solutions it is determined by asurement of electrophoretic mobility. Instru- nts available for measurement of elec- phoretic mobility include various microelec- phoresis cells and the Long-Ross, mass-trans- rt cell with associated power supplies and optics. Both types of instruments are described in detail. A modified microelectrophoresis apparatus suited to dilute solutions which can be employed rapidly, requires only small amounts of solution and requires no microscopic examinations is described in detail. Although the conducting unit and power supply are similar to earlier microelectrophoresis instruments, this version employs a projection and lens-filter system permitting the projections of images of the particles on a screen for rapid easy electrophoretic mobility determinations. General applications of zeta potential to the water and waste water industries are discussed including: colloid precipitation and/or dispersion, control of flocculating agent dosage, alkylbenzene sulfate or detergency control in water and waste water treatment operations and identification of the nature of the surface of living bacteria. There are other uses of zeta potential in the water industry and its uses in waste water treatment and disposal are considered enormous. (Sorber-Texas)
W70-08413

DYNAMICS OF MICROBIAL PROCESS,
Clemson Univ., S.C. Dept. of Environmental Systems Engineering.
H. R. Bungay, and J. F. Andrews.
Water and Sewage Works, Vol 117, No 3, p 77-80, Mar 1970. 1 fig, 9 ref.

Descriptors: *Biological treatment, *Efficiencies, *Waste treatment, *Effluents, *Analog computers, Digital computers, Methane, Biological communities, Aerobic treatment, Anaerobic treatment, Anaerobic digestion, Waste water treatment.
Identifiers: Effluent quality, Methane production.

Although many processes are available for the improvement of effluent quality, the operation of biological waste treatment process at or near peak efficiencies provides considerable economic promise. Process control for biological treatment plants has many possibilities as well as several pitfalls due to the dynamics involved. Currently, some of the indices which can be monitored rapidly (e.g. flow rate, pH, temperature and DO) do not permit complete process control. Others such as BOD take considerable time for assay and its value as a short-term process control is limited. This problem is further complicated by sampling techniques commonly employed. Examples of control processes now in use are discussed. However, most control systems are of the feed-back type from the final effluent stream. In these cases it is often too late to correct a mistake in a biological system. Feed forward control is necessarily applied to systems with either very short or very long response times. Feed-forward control presupposes sufficient understanding of the system to predict the effects of the input notables. When applied to a biological treatment system this means a model of reasonable accuracy must be available. The Monod equation could be helpful in a control system based on population dynamics and nutrient concentration. Long-term projects to provide adequate workable process controls for anaerobic digestors and a forward-feed control system for a conventional waste treatment plant are discussed. Parameters for the digestor include methane production, temperature, pressure and flow rate. (Sorber-Texas)
W70-08414

NEW PLANT CONTROLS POLLUTION AT WELLAND.

Water and Sewage Works, Vol 116, No 11, p 434-435, Nov 1969. 3 fig.

Descriptors: *Waste water treatment, *Treatment facilities, *Costs, *Design criteria, Vacuum drying, Sludge digestion, Chlorination, Performance, Industrial wastes, Domestic wastes, Aeration.
Identifiers: *Primary treatment, Preaeration, Primary settling tanks, Welland, Ontario (Canada).

Domestic and industrial wastes which once polluted the Welland River in Ontario are now being treated at Welland's new primary treatment plant. The plant has an average capacity of 8 mgd with a peak design flow of 20 mgd. Design criteria provides for removal of 95% of grit, 70% of settleable solids and 30% of the BOD. The effluent is disinfected with chlorine and discharged to the river, while the sludge is digested, thickened and vacuum filtered. The plant was designed for future expansion to secondary treatment and a design population of 80,000. The plant features a 75 ft. lift station, a 40 in. Barminutor, a 26 ft square detritor, pre-aeration tanks with a total capacity of 190,000 gal for a detention period of 34 min; four primary settling tanks which provide a detention time of two hours; primary and secondary digesters, a vacuum filter and chlorination equipment. The treatment facility cost $2.35 million and a connecting trunk sewer system cost an additional $5.5 million. (Galwardi-Texas)
W70-08415

EFFECT OF ORGANIC COMPOUNDS ON PHOTOSYNTHETIC OXYGENATION--I. CHLOROPHYLL DESTRUCTION AND SUPPRESSION OF PHOTOSYNTHETIC OXYGEN PRODUCTION,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
Ju-Chang Huang, and Earnest F. Gloyna.
Water Research, Vol 2, p 347-366, 1968. 28 fig, 3 tab, 19 ref.

Descriptors: *Algae, *Chlorophyll, Water pollution effects, *Organic compounds, *Oxygenation, *Photosynthesis, Chlorella, Pesticides, Pesticide toxicity, Photosynthetic oxygen, Productivity, *Waste water treatment.
Identifiers: *Chlorella pyrenoidosa.

This paper describes the inhibition of chlorophyll synthesis and the destruction of chlorophyll in Chlorella pyrenoidosa due to the presence of selected organic compounds. Emphasis is directed toward an explanation of laboratory techniques and an evaluation of changes in photosynthetic oxygen production due to the addition of selected compounds. Changes in extractable chlorophyll concentrations are presented in terms of exposure time and concentration of chemical additives. Selected algal cultures were grown for a test period of 72 hours in test tubes under constant temperature conditions, with continuous illumination, and under controlled nutrient supplies. Under such conditions the chlorophyll content decreases markedly in relation to the concentration of the organic additive. For the compounds evaluated, the chlorophyll reduction seems to be a function of the substituted groups and their relative positions. Also, a direct manometric technique is described for measurement of photosynthetic gas exchange. Results show that oxygen production is suppressed by chlorinated and nitrated phenols. (See also W70-08417). (Aguirre-Texas)
W70-08416

EFFECT OF ORGANIC COMPOUNDS ON PHOTOSYNTHETIC OXYGENATION--II. DESIGN MODIFICATION FOR WASTE STABILIZATION PONDS,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
Ju-Chang Huang, and Earnest F. Gloyna.
Water Research, Vol 2, p 459-469, 1968. 6 fig, 2 tab, 7 ref.

Descriptors: *Design, Water pollution effects, *Organic compounds, *Oxidation lagoons, *Photosynthetic oxygen, Design criteria, Efficiencies, Laboratory tests, Lagoons, Ponds, *Waste water treatment, *Oxygenation.

The potential suppression of dissolved oxygen in ponds and streams due to decreases in photosynthetic oxygenation is described. Studies involving laboratory waste stabilization ponds, operated under controlled conditions, substantiate the predicted decrease in dissolved oxygen and

treatment efficiency. Designs for waste stabilization ponds can be improved by incorporating a chlorophyll loss factor into commonly used design equations. Toxic compounds present in waste streams may affect the operation of waste stabilization ponds in at least four ways. (a) Compounds may inhibit the photosynthetic processes and hence suppress photosynthetic oxygenation. (b) Toxic compounds may inhibit bacterial activity, and reduce the rate of biodegradation of organic compounds. (c) The biodynamic equilibrium of biological populations in the pond may be upset by the presence of certain toxic compounds. (d) Some industrial wastes are toxic and relatively resistant to biodegradation. These compounds may impose an appreciable COD concentration of the effluents. For most of the compounds reported herein, a chlorophyll compensation factor may be expressed. This may be incorporated into the general design equation for waste stabilization ponds. The design standards of waste stabilization ponds can be improved by adding a chlorophyll compensation factor to the developed design equation. (See also W70-08416). (Aguirre-Texas)
W70-08417

APPLICATION OF REVERSE OSMOSIS TO WASTE STREAMS IN CORN PROCESSING INDUSTRY, PART 1,
Ontario Research Foundation, Toronto.
F. K. Besik.
Water and Pollution Control, Vol 107, No 10, p 24-26, Oct 1969. 1 tab, 3 fig.

Descriptors: *Reverse osmosis, *Industrial wastes, *Membrane processes, Chemical oxygen demand, Biochemical oxygen demand, Carbohydrates, Efficiencies, Tertiary treatment, Water reuse, Membranes, Waste water treatment, Effluent streams.
Identifiers: *Cellulose acetate membranes, *Corn processing, Rejection ratios, *Starch industry, Flux rates, Membrane rejections, Waste streams.

The potential and reported uses of the reverse osmosis (RO) process are discussed as they apply to the starch industry, to other industries and to water reclamation. Problems such as membrane fouling and aging are addressed in light of optimum velocities, concentration polarization on the membrane surface and membrane advances. A tube-type pilot reverse osmosis unit was applied to starch wash water and the quality of its performance was judged by the determination of feed and product water total solids, total carbohydrates, COD and BOD. Three different grade membranes rated at 8, 13, and 20 gal/sq ft/day on the basis of 5000 mg/l NaCl at 800 psi were used. BOD and COD rejections were in the range of 99.5 and 97.0% and decreased with increasing membrane permeability. Total dissolved solids rejections ranged between 96 and 75% and also decreased with increasing membrane permeability. Total carbohydrate rejection removed approximately the same for all membranes at 99.5%. During the investigation it was observed that rejection appeared to be independent of initial concentration in the range investigated (0-90 g/l) and that rejection increased with an inverse in operating pressure (400-800 psi). As a result of this study it was concluded that adequate information had been obtained for a preliminary plant design for starch wash water but considerably more detail was required before final application of the design could be made. (See also W70-08419). (Sorber-Texas)
W70-08418

REVERSE OSMOSIS TREATMENT FOR CORN PROCESSING EFFLUENT--PART 2,
Ontario Research Foundation, Toronto.
F. K. Besik.
Water and Pollution Control, Vol 107, No 11, p 47-49, Nov 1969. 10 fig, 18 ref.

Descriptors: *Reverse osmosis, *Industrial wastes, *Membrane processes, Temperature, Pressure, Aging (Physical), Tertiary treatment, Water reuse, Membranes, Waste water treatment, *Effluents
Identifiers: *Starch industry, Flux rates, Permeation constant, Membrane rejection, Corn wastes.

Specific investigations into the interrelationships between pressure drops, various flux rates for tap water and starch wash water, temperature, membrane aging, and the effect of concentration on flux rates were conducted and are discussed in detail. These parameters were considered in order to complete the design of an operating full-scale reverse osmosis system for starch wash water in a corn processing plant. It was concluded that operating pressure had no effect on the permeation constant. It was further concluded that, within the pressure limits of 400-900 psi, compression effects can be neglected for the membranes used. Flux rate was found to be linearly proportional to temperature between 10 and 35 deg C for both tap water and starch wash water and, consequently, it is desirable to operate at the highest temperatures allowed for the equipment and process employed. Flux rate decreased rapidly for increasing concentrations at low or high operating pressures. Concentrations of starch wash water ranged from 1 to 90 g/l and operating pressures from 100 - 800 psi. Short-term aging studies were also conducted (up to 100 hours operating time). Minor decreases in permeation constant were observed to occur with time but a general conclusion was not made due to the relatively short operating periods. Further, increasing the concentration of dissolved matter in the feed water results in an increase in solution osmotic pressure and a decrease in flux rate. (See also W70-08418). (Sorber-Texas)
W70-08419

FILTRATION AND MICROSTRAINING OF SECONDARY EFFLUENT,
Metropolitan Sanitary District of Greater Chicago, Ill.
Vinton W. Bacon, and Bart T. Lynam.
A paper presented at the University of Texas Conference on Advances in Water Quality Improvement, April 1, 1969. Metropolitan Sanitary District of Greater Chicago, Chicago, Ill., April 1, 1969. 41 p, 24 fig, 1 tab, 11 ref.

Descriptors: *Filtration, *Tertiary treatment, *Waste water treatment, *Water purification, *Municipal wastes, *Water reuse, Biochemical oxygen demand, Sewage treatment, Cost comparisons.
Identifiers: *Microstrainers, *Hardinge sand filter, *Suspended solids removal, Metropolitan Sanitary District of Greater Chicago, Hanover Treatment Plant.

This paper presents comparisons of efficiencies and costs of removing suspended solids, and associated BOD, from the activated sludge effluent of the Hanover Sewage Treatment Plant using both continuous rapid-sand filtration and microstraining. This is the first permanent installation of a microstrainer in a tertiary wastewater treatment plant in the United States. The sand filters are of the Hardinge type. The microstrainer is a drum 10 feet in diameter by 10 feet long covered with a stainless steel microfabric having 160,000 openings per square inch. The drum speed and backwash pressure are automatically controlled by the head loss across the drum. It was found that a rational approach for the analysis of data, relative to the performance of filtration devices in treating secondary, activated sludge effluents for removal of suspended solids, would be to consider removal as a function of suspended solids loading in terms of pounds per square foot per day. This takes into account the parameter of hydraulic loading in terms of gpm per square foot, solids input, and the resultant input from the filtration process. The costs of sand filtration and microstraining appear comparable. (Poertner)
W70-08430

INVESTIGATION OF THE FEASIBILITY OF PURIFYING MUNICIPAL WASTE WATER BY DISTILLATION,
Oak Ridge National Lab., Tenn.
I. Spiewak.
Oak Ridge National Laboratory Report ORNL-TM-2547, Oak Ridge, Tennessee, April 1969. 43 p, 9 fig, 7 ref. HUD Interagency Agreement No. IAA-H-3-69.

Descriptors: *Distillation, *Municipal wastes, *Waste water treatment, *Water reuse, *Municipal water, *Water supply, *Water utilization, *Water purification, *Demineralization, Flash distillation, Long tube vertical distillation, Tertiary treatment, Ion exchange, Reverse osmosis, Freezing, Electrodialysis, Nuclear powerplants, Nuclear reactors, Cost comparisons.
Identifiers: *Waste heat utilization.

The report focuses upon the technical and economic feasibility of applying the distillation process for demineralization of municipal waste waters. Principal applications of the method would be for improving the quality of effluents released from treatment plants to receiving streams, and to supplement water supply requirements in urban communities. This investigation is one of a series sponsored by HUD to determine the feasibility of nuclear power plants for the provision of low cost thermal energy to urban areas. Distillation has two potential roles in municipal waste treatment, one as a means of purifying waste water for reuse and second as a step in the ultimate disposal of solids. The technical problems of waste water distillation, described in the literature, are summarized. Cost estimates are given for a number of possible systems using distillation to treat effluent from a city of 1 million population. The analysis indicates that, although advanced waste treatments may increase the cost of sewage processing by factors of up to four times, the overall cost of water supply and treatment need not be increased over about 50%. Distillation appears to be a promising method of waste treatment, although methods of controlling tube fouling and distillate quality remain to be developed. Electrodialysis, reverse osmosis, freezing and ion-exchange are also discussed. (Poertner)
W70-08431

LAKE MICHIGAN WATER QUALITY AS RELATED TO CHICAGO'S WATER TREATMENT PLANTS,
Department of Water and Sewers, Chicago, Ill.
For primary bibliographic entry see Field 05A.
W70-08433

TERTIARY TREATMENT AT METRO CHICAGO BY MEANS OF RAPID SAND FILTRATION AND MICRO-STRAINERS,
Metropolitan Sanitary District of Greater Chicago, Ill.
Bart Lynam, Gregory Ettelt, and Timothy McAloon.
This report of a study, supported in part by a grant from the FWPCA, was presented at the Annual Conference of the Water Pollution Control Federation, September 26, 1968. Metropolitan Sanitary District of Greater Chicago, September 26, 1968. 86 p, 36 fig, 9 tab, 8 ref.

Descriptors: *Tertiary treatment, *Filtration, *Waste water treatment, *Water purification, *Municipal wastes, *Water reuse, Coagulation, Flocculation, Disinfection, Aeration, Water quality control, Municipal water, Treatment facilities.
Identifiers: *Microstrainers, *Rapid sand filtration, Hanover Plant, Metropolitan Sanitary District of Greater Chicago.

The report is a description and evaluation of the design and five month's operating experience at the District's only tertiary waste water treatment facility. It was put into service in 1968 at the Hanover Plant. The facility treats the entire effluent from the secondary, activated sludge, treatment stage, averaging 1.5 mgd of domestic sewage. The basic objectives of the project were to: (1) produce effluent improvements in BOD, suspended solids, disinfection and dissolved oxygen; (2) provide the District with a research and development installa-

n for advanced treatment investigations; and (3) velop design criteria for future tertiary facilities. e tertiary facility consists of chemical clarifica- n and physical separation by filtering using rdinge filters, or by straining. The straining uses Glenfield-Kennedy micro-strainer with auto- tic control. It is the first permanent installation the United States for tertiary treatment. The ility was designed for eight different modes of eration to investigate various treatment com- nations. It was found optimum suspended solids noval was obtained by alum and polymer coagu- ion in combination with sand filtration. Both the cro-strainer and sand filter produced an effluent th suspended solids below the 5 mg/l criteria. nd filtration, with chlorination within the basin, d microstraining after chlorination by contact sin both produced effluents below the 4 mg/l teria for BOD. (Poertner)
70-08434

EMBRANE PROCESSES GAIN FAVOR FOR ATER REUSE,
ater Pollution Research and Applications, Inc., ashington, D. C.
cob I. Bregman.
nvironmental Science and Technology, Vol 4, No p 296-302, Apr 1970. 7 p, 1 fig, 9 tab.

escriptors: *Membrane processes, *Reverse os- osis, Saline water, Pulp wastes, Costs, *Waste ater treatment, *Industrial waste treatment, Acid ine water, Water pollution control, *Tertiary eatment, Water quality, Irrigation water, Water rification, *Water reuse, Water salvage, Water eatment, Sewage treatment, Municipal wastes.
entifiers: *Waste water reclamation, Waste water e.

ew water treatment processes are needed for eanup and reuse of water to meet future industri- and municipal water demands. Conventional ater and waste treatment processes are only par- ally effective against the expanding list of com- ounds contaminating the lakes and rivers. An valuation of 9 tertiary treatment research and evelopment projects shows that the costs of moving organic and inorganic nutrients range om 26 to 30 cents per 1000 gal compared to 11 ents per 1000 gal for secondary treatment. How- ver, waste water reclaimed by tertiary treatment as a higher economic value, offsetting the higher ost of tertiary treatment. Results of field and boratory studies are reviewed on the use of everse osmosis for reclaiming brackish water, acid ine drainage, saline irrigation return flow, paper ill waste effluents, agricultural runoff, and mu- icipal waste water. Problems remaining include: 1) creating tailormade membranes for retention r passage of specific materials, (2) preventing embrane fouling by organics and other trace con- aminants, and (3) preventing flux decline or estoration of flux. (USBR)
V70-08448

5E. Ultimate Disposal of Wastes

LTIMATE SLUDGE DISPOSAL AND SOIL IM- ROVEMENT,
orest Service (USDA), Washington, D.C.
ames O. Evans.
Vater and Wastes Engineering, Vol 6, No 6, June 969, p 45-47. 1 tab, 10 ref.

Descriptors: *Sludge disposal, *Sludge treatment, Nutrients, Nutrient requirements, Sewage sludge, Waste water treatment, *Soil disposal fields, Pennsylvania, Soil treatment.

The value of liquid digested sludge as an agricul- ural asset is discussed in relation to the economics of sludge disposal on farm land, disease transmittal, nd public acceptance of sludge disposal on land. Unthickened sludge contains 2-5% solids. The water portion of the sludge is a supplemental irriga- ion source, and both water and solids contain key nutrients and elements necessary for plant growth. The organic material forms humus, a soil conditioning substance. Sludges applied to farm land in three Pennsylvania communities resulted in higher crop yields and requests for more sludge than was available. The costs of sludge disposal on farm land depends on method of surface spreading, transport distance, mode of transport, and transport efficiency. It may be economical to pump sludge by pipeline up to 100 miles. Disease transmitting microorganisms seem to have a greater longevity in sludge treated soils. Under favorable conditions, the more common intestinal pathogenic organisms might survive up to one year. More research needs to be done in this area. Public acceptance is dependent on aesthetics, economics, and public relations. Sludge disposal on land is gaining gavor in England, where much of the current research on the subject is being done. (Makela-Texas)
W70-08405

5F. Water Treatment and Quality Alteration

A WATER/WASTE WATER GUIDE TO EUROPE, PART I: TREATMENT PRACTICES,
Detroit Metropolitan Water Services, Mich.
For primary bibliographic entry see Field 05D.
W70-08293

A WATER/WASTE WATER GUIDE TO EUROPE: PART 2: ANALYTICAL METHODS,
Detroit Metropolitan Water Services, Mich.
For primary bibliographic entry see Field 05D.
W70-08294

CHEMICAL REMOVAL OF NITRATE FROM POTABLE WATER SUPPLIES,
Kansas Water Resources Research Inst., Manhattan.
Walter J. O'Brien.
Available from the Clearinghouse as PB-193 023, $3.00 in paper copy, $0.65 in microfiche. Kansas State University Water Resources Research Institute Completion Report, Contribution No 23, June 1968. 87 p, 14 fig, 34 tab, 32 ref. OWRR Proj No A-010-KAN.

Descriptors: *Water treatment, *Nitrates, Ion exchange, Ammonia, Costs, Desalination, Water purification, Potable water, Chemical precipitation, Water chemistry.
Identifiers: Nitrate removal.

Removal of nitrate ion from potable waters by chemical reduction at alkaline pH followed by air stripping, and anion exchange using intermediate base and type one strong base resins were investigated. Nitrate reduction to ammonia by ferrous ion at room temperature in the pH range 10 to 11.5 was found to be technically feasible. The process is impractical from an engineering viewpoint, however, because chemical costs for ferrous salts and for pH control are prohibitive and because excessive concentrations of chloride or sulfate are present in the finished water. The intermediate base anion exchange resins tested, when operated on the hydroxide cycle, showed little promise. The strong base type one anion exchange resins tested, when operated on the chloride cycle, showed considerable promise. (Knapp-USGS)
W70-08461

5G. Water Quality Control

SULFIDE TO SULFATE REACTION MECHANISM--A STUDY OF THE SULFIDE TO SULFATE REACTION MECHANISM AS IT RELATES TO THE FORMATION OF ACID MINE WATERS.
Ohio State Univ. Research Foundation, Columbus.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 - Price $1.50. Water Pollution Control Research Series, February 1970. 115 p, 20 tab, 37 fig, 27 ref, 5 append. FWQA Program 14010 FPS---2/70.

Descriptors: *Mine drainage, *Coal mine wastes, *Sulfates, *Chemical reactions, *Acid mine water, *Oxidation, *Sulfides, Pyrite Ferrobacillus, Pollution abatement, Industrial wastes, Water pollution control, Oxygenation.
Identifiers: Coal mine drainage, *Reaction kinetics, Iron sulfides.

A detailed study of the mechanisms and kinetics of the chemical reactions responsible for acid mine drainage has been made. The mineralogical features of the solid phase reactant (pyrite) that determine its reactivity were described. The rate-limiting reactions and variables affecting the rate of these reactions were identified. It was found that two basic oxidation modes are important: oxygenation, in which oxygen is the immediate oxidizing agent; and ferric ion (or microbiologically catalyzed) oxidation, in which ferric ions are the oxidants. From a knowledge of the dissolved oxygen, ferric/ferrous ratio, and total iron ion content at the reaction site, the reaction regime can be determined. Kinetic equations were derived for both reaction modes. From these basic relationships the oxidation rate in real pyritic systems can be accurately predicted when conditions at the reaction site are known. For a given pyrite surface, oxygenation rate is, for all practical purposes, dependent only on the oxygen concentration in the aqueous phase surrounding the reactive site on the pyrite surface. Ferric ion oxidation rate is determined by the ferric/ferrous ratio and free ferric ion concentration in solution, and is not affected by dissolved oxygen. In a real system, the ferric/ferrous ratio is determined by a 'relative' microbial activity; i.e, the number of bacteria per exposed pyrite surface. Bacterial activity is limited by pH and oxygen concentration as well as nutrient levels.
W70-08161

AQUATIC PLANT CHEMISTRY. ITS APPLICATION TO WATER POLLUTION CONTROL,
State Univ. of New York, Syracuse. Coll. of Forestry.
Robert T. LaLonde.
Available from the Clearinghouse as PB-192 810, $3.00 in paper copy, $0.65 in microfiche. Water Quality Research Series Report. July 1970. 40 p, 7 tab, 1 fig, 26 ref. FWQA Project 16020DHVO---7/70. FWQA Contract 921141.

Descriptors: *Bacteria, *Antibiotics, *Chemistry, *Rooted aquatic plants, Aquatic bacteria, Hydrophytes, Chemical properties, Chemical analysis, Ecology.
Identifiers: *Alkaloids, *Nuphar, Nuphar alkaloids, Chemical ecology.

Possibly aquatic plants can play a role in aquatic ecology through the production and release of biologically active agents. The research objective was to determine the presence, chemical nature and biological activity of plant-produced agents. Nuphar luteum subsp. variegatum and macrophyllum produce both C-15 alkaloids and C-30, sulfur-containing alkaloids. Two of the latter type were isolated. Both were determined as stereoisomeric biscarbinolamines incorporated into two deoxynupharidine moieties linked together at C-7 through a thiaspirane ring. Two new C-15 alkaloids, 7-epideoxynupharidine and 3-epinuphamine, were discovered in N. luteum subsp. variegatum. Both C-30, sulfur-containing alkaloids were active against Corynebacterium michiganese. The more abundant of the two C-30 alkaloids was tested further against five additional phytopathogenic bacteria and was active against four of these. The same alkaloid was inactive against three bacteria taken from the site where the plant material was harvested. C-15 alkaloids, nupharidine and deoxynupharidine, were inactive against C.

michiganense, the bacteria most sensitive to the sulfur-containing alkaloids. There is now sufficient indication that Nuphar produces agents which are active against some phytopathogenic bacteria. The extent of the release of Nuphar-produced agents into the surrounding aquatic environment should be studied.
W70-08162

SPREADING AND MOVEMENT OF OIL SPILLS,
New York Univ., Bronx. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 05B.
W70-08163

STUDIES ON LIMESTONE TREATMENT OF ACID MINE DRAINAGE, OPTIMIZATION AND DEVELOPMENT OF IMPROVED CHEMICAL TECHNIQUES FOR THE TREATMENT OF COAL MINE DRAINAGE.
Bituminous Coal Research, Inc., Monroeville, Pa.
For primary bibliographic entry see Field 05D.
W70-08167

JERSEY CITY V STATE WATER POLICY COMM'N (JURISDICTION OVER WATER PURITY).

191 A 456-459 (NJ Ct Err and App 1937).

Descriptors: *New Jersey, *Legislation, *Administrative agencies, *Administrative decisions, Potable water, Water quality, Public health, Percolating water, Subsurface waters, Adjudication procedure, Judicial decisions, Marshes, Evaporation, Water storage, Dams, Legal aspects, Regulation, Permits, Jurisdiction.

Plaintiff city sought review of defendant Water Policy Commission's authorization for dam construction. Plaintiff contended that such construction would endanger the purity of the public water supply and thereby constitute a hazard to public health. Defendant argued that the question of public health was not within the scope of its jurisdiction and that such questions had to be answered by the State Board of Health. The Court of Errors and Appeals of New Jersey, construing the statute creating defendant Commission, reasoned that defendant was invested with broad comprehensive powers over water management. Although the Board of Health had jurisdiction over sanitary water conditions, the court reasoned that it would be a frustration of legislative intent to say that defendant was without interest in this area. The court ruled that defendant must reconsider its decision to grant the permit, this time taking the potability of the water into consideration. (Barker-Florida)
W70-08215

EVALUATION OF POTENTIAL ACID MINE DRAINAGE,
Carnegie-Mellon University, Pittsburgh, Pa.
Robert A. Baker, and Albert G. Wilshire.
Water and Sewage Works, Vol 117, No 6, p IW/10, 12, 14, 16, June 1970. 4 p, 2 fig, 3 tab, 13 ref. FWQA Contract 14010 DKN F.

Descriptors: *Acid mine water, *Water pollution control, *Laboratory tests, Pilot plants, Leaching, Iron bacteria, Sulfur bacteria, Chemical reactions, Water chemistry, Acidic water, Acid streams, Biochemistry
Identifiers: Acid mine drainage control

Oxidation of iron pyrite, FeS2, exposed during coal mining results in release of acidity and ferrous iron which imposes a major pollutional loading on receiving bodies of water. Original ferrous iron release may be by dissociation or oxidation of pyrite. Subsequently, a cyclic process occurs in which the ferrous iron is oxidized to the ferric state by oxygen. In turn, the ferric iron is reduced by the pyrite generating more ferrous iron. Chemoautotrophic bacteria are known to be involved in pyritic oxidation but their precise role has not been established. Pyrite oxidation may occur without these organisms. They may directly catalyze the overall chemical reaction rates or serve as specific agents which alter the intermediate reactions and hence the nature of the resulting byproducts but not the overall oxidation rate. The chemical and biological factors are being investigated by pilot plant methods which permit achievement of equilibria under controlled dynamic conditions. Equilibria are achieved under aerobic and nonaerobic conditions, with and without biological seeding and at fixed hydraulic flow rates. Excluding oxygen does not prevent pyrite dissolution, and a steady state release of ferrous iron results under dynamic conditions. Mine sealing practices to eliminate air entry may reduce but will not eliminate acid release. (Knapp-USGS)
W70-08234

SWICK V WEST VIRGINIA COAL AND COKE CO (DAMAGE TO LAND BY MINE DRAINAGE).

7 SE2d 697-699 (W Va 1940).

Descriptors: *West Virginia, *Property values, *Prescriptive rights, *Mine drainage, Mine water, Mine wastes, Ditches, Compensation, Coal mines, Waste disposal, Pumping, Land tenure, Damages, Land use, Land appraisal, Legal aspects, Judicial decisions, Industrial wastes, Damages, Drainage, Real property.

Plaintiff, owner of certain property as a remainderman, sought recovery for permanent damage thereto. The damage was caused by defendant mining company's having discharged mine water into a ditch across plaintiff's land. Plaintiff's mother, the life tenant, had given permission to the company to use the ditch. The lower court held for plaintiff. The appellate court acknowledged the right of a remainderman to sue for permanent damages caused to his land and to recover the diminution in the market value of the property. However, the court reversed, stating that the evidence failed to show that the value of the property had been reduced by the acts complained of. The court rejected the contention of the defendant that it had acquired a prescriptive right to use the ditch, stating that a permissive use based on verbal agreement could not ripen into a prescriptive right. (Hubener-Florida)
W70-08282

INLAND STEEL CO V ISAACS (FLOOD DAMAGE FROM MINE WATER).
143 SW2d 503-505 (Ky 1940).

Descriptors: *Kentucky, *Mine drainage, *Riparian rights, *Flood damage, Water pollution sources, Overland flow, Land use, Land tenure, Legal aspects, Mine water, Watercourses (Legal), Water release, Streams, Creeks, Currents (Water), Groundwater movement, Damages, Channels, Conduits, Leases, Contracts, Water storage, Judicial decisions.
Identifiers: *Mineral deed.

Defendant steel company was engaged in mining operations in Kentucky. Plaintiff owned 150 acres of land subject to defendants' mineral deed. One acre of land, which contained plaintiff's house, was excepted from this mineral deed. Defendant's mine flooded, causing damage to plaintiff's house and the pollution of his well. The court stated that an upper landowner is liable for damages to a lower landowner if he changes the ordinary flow of a stream or causes it to collect, and then casts it upon the lower estate in a larger volume or swifter current than normal. The mineral deed only gave defendant rights consistent with the interest and rights of plaintiff. Defendant was entitled to discharge water on plaintiff's land as was necessary or convenient in accordance with the mineral deed. However, the one acre of land containing plaintiff's house and well was excepted by the deed. Consequently, plaintiff had a cause of action for damages regarding the one acre. (Leesfield-Florida)
W70-08353

DISPATCHING SYSTEM FOR CONTROL OF COMBINED SEWER LOSSES,
Minneapolis-St. Paul Sanitary District, Minneapolis, Minn.
James J. Anderson.
An Interim Report to the Federal Water Pollution Control Administration. Minneapolis-St. Paul Sanitary District, Minneapolis, Minn., May 1969. 115 p, 76 fig, 20 tab. FWPCA Project 1-Minn.-1.

Descriptors: *Flow control, *Gate control, *Control systems, *Computers, *Telemetry, *Automatic control, *Regulated flow, *Pollution abatement, *Remote sensing, *Remote control, Data processing, Maintenance, Surface runoff, Sewers, Outlets, Urbanization, Monitoring, Mississippi River, Minnesota.
Identifiers: *Computer control of combined sewers, *Combined sewers, *Overflow regulators, Interceptors, Minneapolis-St. Paul Sanitary District.

The report describes a $1,741,000 demonstration project initiated as part of a national program designed to find alternatives to the costly method of sewer separation for reducing pollution of receiving waters from overflows of combined sewers. Key combined sewer regulators in the Minneapolis-St. Paul sewer system were modified. A system for remote control of these regulators and a system for monitoring liquid levels in major sewers are operational, using a small process control computer and leased telephone lines. Remote reading rain gages were connected to the system to permit using a mathematical model in the computer to predict storm flows in the interceptors and to guide operation of the regulators. To evaluate the effectiveness of these system modifications and the pollution caused by the sewer system, existing District data was converted to data processing form, the hourly strengths of wastes in the system were determined, and five robot monitors were installed to automatically record river water quality. The system, which is now operational, is said to be the most advanced of any municipal system in the United States. Significant reductions of pollution of the Mississippi River from overflows are attributed to: manual-remote monitoring of sewer levels, regulator modifications, and improved regulator maintenance. The program has demonstrated that overflow regulators can be remotely controlled using a computer-based telemetry system. The original completion date of July 1, 1969 cannot be met because of delays caused by a flood and contract difficulties. (Poertner)
W70-08435

CHARACTERIZATION AND TREATMENT OF COMBINED SEWER OVERFLOWS.
Engineering-Science, Inc., Arcadia, Calif.

City and County of San Francisco, San Francisco, California, November 1967. 202 p, 59 fig, 24 tab, 21 ref. FWPCA Grant WPD-112-01-66.

Descriptors: *Pollution abatement, *Discharge, *Overflow, *Discharge measurement, *Gates, *Outlets, *Impaired water quality, Water pollution effects, *Water pollution, *Sewage effluents, Flotation, Chlorination, Aeration, Sewerage.
Identifiers: *Combined sewer overflow, *Combined sewers, Sewer discharges, San Francisco, San Francisco Bay.

This publication is the final report of a study made by the City and County of San Francisco to develop workable systems to manage overflows from the combined sewers of San Francisco. The ultimate objective is to alleviate pollution of the Bay and the Pacific Ocean caused by sewer overflows. The

elby Street sewer system and the Laguna Street stem were used as study sites. Storm overflows ere monitored for quantity and quality charac-ristics. Rain gage measurements were also ecorded. A coliform survey of the municipal arina was made, and laboratory tests were con-ucted to select suitable methods for treating com-ned sewer overflows. The project findings were: 1) concentrations of various constitutents in the verflows follow a distinct pattern; (2) the decay me is constant; (3) separation of sewers would not sult in any significant reduction in the pollution f receiving waters; (4) coliform levels in receiving aters are significantly affected by wet weather ischarges; and (5) treatment of combined sewer verflows, using the dissolved air flotation process conjunction with chlorination, appears to be the ost feasible solution. Recommendations are made o continue the study and to construct a small treat-ent facility to treat the overflows from one of the inor outfalls of the City sewer system. The report ontains many figures, tables, illustrations and ex-ellent photographs of combined sewer overflow utfalls in the San Francisco system. The two study tes comprise 15 per cent of the City's habitable rea, mostly residential in land use. (Poertner)
W70-08436

RESERVOIR MIXING AND AERATION YSTEM,
linde Engineering Co., Highland Park, Ill.
. Nelson Hinde.
Vater and Wastes Engineering, Vol 7, No 3, p 50-3, Mar 1970. 4 p, 5 fig, 5 ref.

Descriptors: *Reservoirs, *Lakes, *Aeration, Reaeration, Dissolved oxygen, Air compressors, Air entrainment, Oxygenation, Limnology, Eutrophication, Aquatic life, Mixing, Aquatic environment, *Water quality, *Impounded waters, Turnovers, Plastic tubing.
Identifiers: Reservoir management, Air bubbles, Air release valves, *Bubbles system.

A system for aerating and mixing impounded water s described. Development of the system was based on: (1) increasing horsepower efficiency to move 0 to 1000 times as much water per hp as provided by other methods, (2) reducing bubble-rise rate to ess than 1 fps to eliminate turbulence and create a aminar uplift, (3) reducing bubble size to dissolve oxygen quicker, (4) inducing continuous turnover rom the rise of bubbles, (5) improving water quali-y by eliminating anaerobic conditions at the lake ottom, (6) reducing installation and operation osts. The system uses 0.5-in.-inside-diameter lastic pipe weighted by a lead strip. Air bubble heck valves are sized and spaced to meet water depth and circulation requirements. Air compres-or capacity and horsepower requirements are determined according to depth and length of tubing nstalled. The entire bottom of the lake need not be overed; sufficient circulation will be produced by placing tubing in one or more deeper areas. In deeper lakes the water rotates slowly to a distance of 15 mi from the aeration area. Within a relatively short period, bottom water is mixed, temperatures are equalized throughout the lake, accelerated eutrophication effects are overcome, and water quality is improved. (USBR)
W70-08449

WILLIAMS V PELICAN NATURAL GAS CO (MEASURE OF DAMAGES FROM OIL AND SALT WATER POLLUTION).

187 La 462, 175 So 28-34 (1937).

Descriptors: *Louisiana, *Damages, *Water pollution, *Fishkill, Pollutants, Water pollution effects, Water pollution sources, Oil industry, Oil, Oil wastes, Oil fields, Saline water, Fish, Dams, Swimming, Recreation, Ponds, Surface waters, Trees, Stock water, Judicial decisions, Legal aspects, Water quality, Water utilization, Adjudication procedure.

Plaintiff landowners sought damages from defendant oil companies as a result of oil and salt water pollution of a stream running through plaintiffs' land. Defendants operated several oil wells upstream from plaintiffs' property and had discharged salt water and waste oil into the stream. Plaintiffs alleged damages from fish kill, destruction of a pond dam, interference with swimming, timber loss, loss of sale of fresh water, and loss of water for stock. The trial court found defendants liable and awarded damages. Defendants appealed solely on the basis of the amount awarded. The Supreme Court of Louisiana, in amending the total award, ruled that damages from the fish kill could not be ascertained in that the number of fish found dead was uncounted. Moreover, evidence showed that the fish could escape from the pond built by plaintiffs. The award for loss of water sale was also stricken since it was shown that such sale would not have occurred regardless of the pollution. Judgment for the plaintiffs was affirmed as amended. (Barker-Florida)
W70-08451

WATER STUDIES IN OREGON.
Oregon State Univ., Corvallis. Water Resources Research Inst.

Oregon State University Water Resources Research Institute Fall Quarter 1969 Seminar, WR 012.69, Corvallis; published Janauary 1970. 131 p.

Descriptors: *Conferences, *Water resources, *Oregon, Water pollution control, Lumbering, Evapotranspiration, Forest management, Land management, Fisheries, Energy budget, Radioactive waste disposal, Hydrology, Thermal powerplants, Thermal pollution, Estuaries, Water law, Recreation, Treaties.
Identifiers: Oregon State University.

Seminars in water resources at Oregon State University in 1969 are compiled. They are the product of weekly presentations which included such varied subjects as water quality, water supply, tainted fish, thermal pollution, water treaty interpretations, economic impact, and cost sharing in recreation. Some of the investigations have been in progress only a relatively short period of time and the reports are preliminary in nature. The lectures were open to faculty members, students of all ages, representatives of federal and state agencies, and the general public. (See also W70-08476 thru W70-08478). (Knapp-USGS)
W70-08475

STRATIFIED RESERVOIR CURRENTS, PARTS 1 AND 2,
Oregon State Univ., Corvallis. Engineering Experiment Station.
For primary bibliographic entry see Field 02H.
W70-08501

JERSEY CITY V STATE WATER POLICY COMM'N (CREATION OF LAKE VIA DAM CONSTRUCTION AND RIGHTS OF CITY ON RIVER BELOW).

181 A 873-875 (NJ 1935).

Descriptors: *New Jersey, *Water demand, *Impounded waters, *Water supply, Municipal water, Pollutants, Public health, Recreation wastes, Administrative decisions, Permits, Public rights, River flow, Dams, Spillways, Water storage, Riparian rights, Artificial use, Navigable waters, Reasonable use, Impoundments, Artificial watercourses, Reservoirs, Judicial decisions, Legal aspects.

Plaintiff city instituted a certiorari proceeding against the State Water Policy Commission and a realty company. Defendant realty company had been granted, pursuant to a state statute, a permit to construct a dam in a river to create a lake. Below the lake, in the same river, was a reservoir which was the source of the city's water supply. Plaintiff contended that the creation of the lake and the construction of bungalows and privies near the lake would result in a diminished and polluted water supply. The court found that the Commission had required and defendant had agreed to special conditions with regard to the construction of privies and the general use of the lake area so as to preclude pollution problems. The court also found that any reduction in the city's water supply would be minimal. The suit was dismissed with costs. (Price-Florida)
W70-08503

A STUDY OF WATER PLANT ISOLATION FROM CONTAMINATION,
National Nuclear Corporation, Palo Alto, Calif.
For primary bibliographic entry see Field 03A.
W70-08504

A TEST OF FLUSHING PROCEDURES TO CONTROL SALT-WATER INTRUSION AT THE W. P. FRANKLIN DAM NEAR FT. MYERS, FLORIDA,
Geological Survey, Tallahassee, Fla.
Durward H. Boggess.
Florida Bureau of Geology Information Circular No 62, Part 1, p 1-15, 1970. 15 p, 8 fig, 3 tab, 1 ref.

Descriptors: *Saline water intrusion, *Canals, *Water pollution control, *Locks, *Florida, Streamflow, Lowflow, Density currents, Mixing, Sea water, Navigation, Water pollution.
Identifiers: Canal operating procedures, Caloosahatchee River (Fla).

During low-flow periods, salty water from the tidal part of the Caloosahatchee River moves upstream during boat lockages at the W. P. Franklin Dam near Ft. Myers, Florida. The salty water moves upstream within the deeper parts of the river channel as far as 5 or more miles above the lock. Some mixing of the high-chloride deeper water and the fresher shallow water occurs in the affected reach above the lock, probably as a result of wind and waves, and turbulence created by boat traffic. Salt water can be flushed from the lock chamber prior to lockages at openings of 4, 6 and 8 feet. An opening of 8 feet or more appears preferable because of the smaller volume of water required and shorter discharge time involved. The quantities of salt water moving upstream can be effectively reduced by adopting changes in locking procedures. Flushing the lock chamber could result in a 50 percent reduction, whereas a combination of procedures would be even more effective in controlling salt-water intrusion. Under the present circumstances it appears unlikely that complete control and prevention of upstream salt water movement can be accomplished from a change in procedures as described; nor does it appear that complete control is entirely necessary if measures are started early in the dry season at the first indications of salt-water intrusion. (See also W70-08517). (Knapp-USGS)
W70-08516

SEIDEN V PASSAIC VALLEY WATER COMM'N (LIABILITY FOR SEDIMENT IN WATER SUPPLY).

199 A 420-423 (NJ Dist Ct 1938).

Descriptors: *New Jersey, *Water supply, *Impaired water quality, *Filtration, Administrative agencies, Filters, Water demand, Reservoirs, Plumbing, Judicial decisions, Legal aspects, Water conveyance, Water distribution (Applied), Water quality control, Potable water, Domestic water, Water purification, Conduits, Cities, Sands, Hydraulics, Hydraulic structures, Pressure conduits, Trap efficiency.

Plaintiff brought an action for damages to his plumbing system caused by the allegedly negligent failure of defendant to remove excess sand from its water supply. Defendant contended that its only duty was to deliver potable water fit for domestic

use. The court conceded that the water must be potable and fit for domestic use and also free from sediment which would affect plaintiff's plumbing. Defendant was under a legal duty to properly distribute the water, being just as liable for injuries to plaintiff's property resulting from water containing excess sand as it would be for injuries to the plaintiff's person resulting from polluted water. The doctrine of res ipsa loquitur was found to apply where the water containing the sand came exclusively from defendant's water mains into plaintiff's plumbing system. The presence of the sand in the water was an 'unusual occurrence' which made the doctrine applicable. The court found that defendant, in the exercise of reasonable care, should have discovered the presence of the sand in the water, and its failure to do so rendered it liable for plaintiff's damages. (Barnett-Florida)
W70-08519

CLINARD V TOWN OF KERNERSVILLE (DAMAGES TO LAND CAUSED BY OVERFLOW OF POLLUTED STREAM).
215 N C 745, 3 SE2d 267-272 (1939).

Descriptors: *North Carolina, *Cities, *Water pollution, *Eminent domain, Easements, Streams, Banks, Judicial decisions, Legal aspects, Shrubs, Obstruction to flow, Brush, Damages, Riparian rights, Flooding, Ditches, Municipal wastes, Sewage disposal, Environmental sanitation, Waste water disposal, Timber piles, Basins, Dye releases, Remedies, Overflow.
Identifiers: Nuisance (Continuing).

Plaintiff sought in a continuing nuisance action to recover damages to his real property caused by the pollution and overflow of a stream thereon. The stream also emitted noxious odors as a result of the pollution. The pollution was allegedly caused by emissions of waste water from defendant city's sewage disposal plant and by dye water discharged by defendant knitting mill. The overflow of the stream was allegedly caused by defendant city's filling in of the stream with timber and shrubbery. Upon finding that defendant mill had no control over the discharge of its dye water into the stream, since it deposited such water into a basin controlled by defendant city, the appellate court allowed a non-suit as to defendant mill. Defendant city was held responsible; however, the court construed the plaintiff's remedy as one in the nature of a condemnation proceeding. The court stated that except as affected by rights peculiar to riparian ownership, plaintiff's recovery did not depend on whether the damage was caused by the polluted water or noxious air therefrom. Instead, the injury was deemed a taking for which defendant city had to compensate plaintiff. After such payment defendant city obtained a permanent easement in plaintiff's land. (Barnett-Florida)
W70-08548

MICHELSEN V LESKOWICZ (DUCK FARM ON STREAM AS NUISANCE).

55 NYS2d 831-841 (Sup Ct 1945).

Descriptors: *New York, *Ducks (Domestic), *Zoning, *Diversion, Stream, Competing uses, Riparian rights, Reasonable use, Judicial decisions, Legal aspects, High water mark, Hurricanes, Bogs, Erosion, Thalweg, Boundaries (Property), Oceans, Alteration of flow, Tides, Animal wastes (Wildlife), Remedies, Adjudication procedure, Odor, Riparian land
Identifiers: *Nuisance, Feces.

Defendant upstream riparian owner raised ducks on the stream adjoining both his and plaintiff's property. Plaintiff, a downstream owner, brought action alleging that: (1) defendant had unlawfully diverted the stream waters; (2) defendant was trespassing on plaintiff's property by use of a footpath thereupon, and (3) defendant's ducks were a nuisance in that they created odor and noise and polluted the water by fecal discharge. The appellate court held that: (1) plaintiffs were not injured by the defendant's slight scooping of soil from the creek bed, which had caused a minor recession of water from plaintiff's side of the stream; (2) defendant's use of the footpath was a trespass which should be enjoined; and (3) defendant could not be enjoined from raising ducks because of laches on the part of the plaintiff. Defendant had been raising ducks continuously on the property for 40 years, and plaintiff's failure to object within that time precluded any injunction. Moreover. the defendant's property was zoned for such purpose. Also, plaintiff had moved to the nuisance and could not therefore complain. (Barnett-Florida)
W70-08553

CITY OF LYNCHBURG V CHESAPEAKE AND O RY (PRESCRIPTIVE RIGHT OF CITY TO HAVE CANAL MAINTAINED FOR SEWAGE DISPOSAL PURPOSES).

195 SE 510-514 (Va 1938).

Descriptors: *Virginia, *Prescriptive rights, *Canals, *Sewage disposal, Easements, Land tenure, Discharge lines, Outlets, Railroads, Inland waterways, Water supply, Relative rights, Remedies, Legal aspects, Judicial decisions, Water rights, Water levels, Flow control, Public benefits, Maintenance costs, Municipal wastes, Legislation, Public rights, Aqueducts.

Defendant railroad had previously obtained permission to abandon a canal near plaintiff city. Plaintiff sought to enjoin defendant from closing the canal, claiming that it had acquired a prescriptive right to have the railroad maintain the canal at a level suitable for sewage disposal by the city. The court stated that a prescriptive right to empty sewers into private water courses could be maintained by the city. Plaintiff, however, sought to force defendant to maintain a sewage disposal system for the city at the railroad's expense. The court held that in the absence of an express contract to the contrary, such an obligation to do a positive act was not imposed on defendant by plaintiff's easement. Furthermore, the canal itself had taken on many aspects of property dedicated to a public use to which no prescriptive rights could attach. Therefore, the court held that plaintiff could not force defendant to maintain the canal. (Caldwell-Florida)
W70-08561

MAYOR OF CAMBRIDGE V DEAN (POWER OF PUBLIC OFFICIAL TO BRING SUIT TO ABATE POLLUTION).
14 NE 2d 163-166 (Mass 1938).

Descriptors: *Massachusetts, *Pollution abatement, *Local governments, *Remedies, Industrial wastes, Water pollution, Impaired water quality, Water supply, Cities, Public health, Legal aspects, Judicial decisions, Legislation, Relative rights, Water pollution control.

Plaintiff mayor of Cambridge sought to enjoin the operation of a piggery located in adjoining localities. The piggery was situated upstream, and pollution from its operation affected Cambridge's water supply. The court held that as an individual plaintiff had no right to maintain the suit, and his right as mayor was no greater than his individual right. The court indicated that had the suit been brought in the name of the city, or had a statute authorized the mayor to sue in his official capacity, a cause of action would have been stated. Although there were statutes forbidding certain acts connected with the keeping of pigs and other animals within a prescribed distance of streams, the complaint did not allege violations of these provisions. Therefore the complaint was dismissed. (Caldwell-Florida)
W70-08562

THOMPSON V CITY OF MALDEN (DISPOSAL OF SEWAGE).
118 SW2d 1059-1065 (Mo Ct App 1938).

Descriptors: *Missouri, *Drainage districts, *Cities, *Waste water disposal, Drainage, Ditches, Drainage systems, Drainage water, Sludge Treatment, Coliforms, Flow, Pipes, Drains, Drainage effects, Outlets, Liquid wastes, Effluents, Sewage effluents, Waste water treatment, Judicial decisions, Legal aspects, Waste water (Pollution), Municipal wastes, Remedies.

Plaintiff drainage district sought an injunction to restrain defendant city from connecting a sewer outlet to one of plaintiff's drainage ditches. Plaintiff alleged that defendant was discharging noxious chemicals and sewage into the ditch, thereby polluting the water in violation of applicable law. Defendant admitted such acts but alleged that: (1) the sewage disposal plant was of the most approved pattern; (2) the sewage was converted into an inoffensive fluid state; and (3) prior to building the plant, defendant had obtained oral permission from the county court to discharge the sewage into the ditch, although such permission had since been revoked. From a judgment for plaintiffs granting a permanent injunction, defendant appealed. In affirming, the appellate court held that the act of connecting with the drainage ditch was illegal, without color of law and of itself a legal wrong in that it attempted to subordinate the ditches of the plaintiff to a user by the city without first complying with the applicable statute requiring negotiation of a binding contract, with adequate consideration, between defendant and plaintiff. (Barnett-Florida)
W70-08568

RIGGS V CITY OF SPRINGFIELD (WATER POLLUTION DAMAGES FROM DISPOSAL OF MUNICIPAL SEWAGE).
126 SW2d 1144-1153 (Mo 1939).

Descriptors: *Missouri, *Municipal wastes, *Sewage disposal, *Water pollution, Water pollution sources, Sewage, Wastes, Sewage effluents, Sanitary engineering, Waste disposal, Effluents, Pollutants, Impaired water quality, Water pollution effects, Fouling, Odor, Riparian rights, Judicial decisions, Damages, Relative rights, Legal aspects.

In an action for damages, plaintiff riparian landowners contended that defendant city had emptied sewage into a stream which crossed their land, thereby polluting the water and creating unpleasant odors so as to diminish the value of such land. Defendant contended that it had appropriated the use of such stream pursuant to statutory authorization, and that any claim for damages had accrued at the time of initial appropriation. Defendant therefore contended that plaintiffs' action was barred by the running of a five year statute of limitation. The court held that the law of eminent domain applied and not the law of nuisance. Thus the city's appropriation through its eminent domain power of the right to use the stream for sewage disposal purposes created a cause of action for permanent damages which accrued, if at all, at the time of such initial appropriation. Five years having run from such initial appropriation, the plaintiffs' claim was barred by the statute of limitations. (Snow-Florida)
W70-08571

KING V CITY OF ROLLA (WATER POLLUTION DAMAGES CAUSED BY MUNICIPAL SEWAGE DISPOSAL).
130 SW2d 697-702 (Mo Ct App 1939).

Descriptors: *Missouri, *Water pollution, *Municipal wastes, *Sewage disposal, Disposal, Impaired water quality, Pollutants, Treatment facilities, Wastes, Water pollution sources, Sewage, Septic tanks, Streams, Effluent streams, Waste disposal, Sewage effluents, Sanitary engineering, Relative rights, Legal aspects, Judicial decisions, Damages.

In an action for damages, plaintiff alleged that defendant municipality had discharged sewage from a septic tank into a creek which flowed through plaintiff's land. Plaintiff contended that such

scharge rendered such creek unfit for farm use d gave off offensive odors so as to diminish the arket value of his land. Defendant contended that e action was barred by the running of a five year atute of limitation. The court stated that under e law of eminent domain, which requires com- nsation for property taken by condemnation or appropriation, a cause of action arises at the ne the use of a stream is first appropriated. Under e law of nuisance, there is a continuing accrual of cause of action. The court held that the instant se was governed by the law of eminent domain, d consequently, since the creek was first used e years prior to the bringing of the action, the atute of limitations barred recovery. (Snow- orida)
70-08572

EWER IMPROVEMENT DIST NO 1 V JONES DAMAGES FOR IMPROPER MAINTENANCE F SEWAGE FACILITIES).
34 SW2d 551-555 (Ark 1939).

escriptors: *Arkansas, *Eminent domain, Remedies, *Sewage disposal, Sewers, Cities, Vaste water disposal, Municipal wastes, Ditches, ffluents, Sewage effluents, Waste water (Pollu- on), Conduits, Septic tanks, Structures, Pipes, rains, Judicial decisions, Legal aspects, Odor, Vater pollution effects, Riparian rights, Streams, ssessments, Damages, Compensation.

laintiff brought action against defendant sewer istrict for damages to his land occasioned by the nproper maintenance and operation of a septic nk and two ditches through which polluted water rossed his land. It was undisputed that the septic nk was erected more than 3 years prior to suit nd that, in fact, the tank was not properly main- ined. From a verdict for plaintiff in the lower ourt, defendant appealed. The court found that efendant, under its right of eminent domain, had aused ditches to be dug across plaintiff's lands into hich polluted water flowed. For this, plaintiff had he right to be fully compensated for any damages uffered as a result thereof, based upon the theory f a permanent taking under the right of eminent omain, if suit were brought within three years of he exercise of such right. Since that had not been one in the instant case, plaintiff's action was arred by the statute of limitations. However, the ourt stated that the limitation upon the time ithin which suits for damages must be brought oes not apply to a suit to abate a nuisance. Defen- lant's plant, so maintained and operated as ad- nitted in the court below, was a nuisance which ould be abated through an action in equity. (Bar- ett-Florida)
W70-08573

06. WATER RESOURCES PLANNING

6B. Evaluation Process

ANTHROPOLOGICAL ANALYSIS OF SOCIAL AND CULTURAL BENEFITS AND COSTS FROM STREAM CONTROL MEASURES, Phase I,
Kentucky Univ., Lexington.
Henry F. Dobyns.
Project Completion Report, January 1-June 30, 1969. 8 p. OWRR A-022-KY (1).

Descriptors: *Social change, *Social impact, Kentucky, Dams, Drainage systems, Costs, Regulated flow.
Identifiers: *Anthropological data, *Social benefits, *Cultural benefits.

Anthropological research was initiated to collect data concerning social indicators to anticipate possible cultural changes in three central Kentucky river drainages as a result of dams being planned for them. The basic field research procedure broke down overall project objectives into geographic areas and methodological tasks which could be managed by individual students. A unique feature of this project was the use of secondary school students who served as research aids and kept precise household records. Papers initiated during Phase I of this project included: 'Ethnohistory and Contemporary United States Social Problems' (a summary of findings of the institutional inventory of settlements in twelve Kentucky counties); 'Economic Institutions as Social Indicators' (a paper demonstrating how anthropological data, such as kinship, may be employed as a social indicator); 'The Differential Effects of Advanced Communication, Transportation, Centralization and Affluence on Disaster Relief in a Kentucky Town' (the process of settlement competition, with selective decline and growth); 'Industrialization Without Modernization' (major socio-economic development factors made in a single county with a varied ecology); and 'Whither the Country Shore: A Special Case in the Historical Process of Institutional Centralization.' (Starr-Chicago)
W70-08150

EVALUATION OF THE SOCIAL IMPACT OF RESERVOIR CONSTRUCTION ON THE RESIDENTIAL PLANS OF DISPLACED PERSONS IN KENTUCKY AND OHIO,
Kentucky Water Resources Inst., Lexington.
Richard L. Ludtke, and Rabel J. Burdge.
Available from the Clearinghouse as PB-192 808, $3.00 in paper copy, $0.65 in microfiche. Research Report No 26, 1970. 160 p, 3 tab, 36 fig, 66 ref. OWRR Project A-020-KY (1).

Descriptors: *Social aspects, *Social adjustment, Social change, *Attitudes, Kentucky, Ohio, Population, Decision making, *Reservoirs.
Identifiers: Demography, *Migration (Population).

The states of Kentucky and Ohio have numerous reservoir projects at various stages of planning and construction. Each of the projects produces substantial social impact for the residents of the area and particularly for those persons affected by a loss of property and homes. This impact is not uniform in that people respond differently to displacement and the methods of adjusting relocation are known to differ among people. This research was initiated to develop and test a model for explaining migration under such conditions. The model includes a consideration of people's potential for transferring existing statuses to new residences, the extent to which peoples interests are served by the reservoir, people's knowledge of the reservoir, the social class levels of those displaced and the extent to which people identify with their places of residence. These factors are viewed as affecting people's levels of apprehension and consequently their willingness to separate from their current membership systems. Data for this investigation come from all the adult residents of the areas to be flooded near Taylorsville, Kentucky and Lebanon, Ohio. These areas are in the Louisville District of the U.S. Army Corps of Engineers and exhibit similar topographies with rural populations of similar socio-economic and social isolation. The testing of this model indicated that apprehensions over money is great for those persons who identify strongly with their present homes. Also, apprehension over migration was less for those persons whose vested interests were served by the project. Knowledge of the reservoir project did not reduce apprehensions over moving as was predicted by the model.
W70-08155

WATER QUALITY: COSTS BENEFITS OF IRREDUCIBLES,
Stone (Ralph) and Co., Inc., Los Angeles, Calif.
For primary bibliographic entry see Field 05D.
W70-08328

EFFECT OF MUNICIPAL WATER SERVICE POLICIES ON ECONOMIC GROWTH IN SUBURBAN AREAS,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
George I. Whitlatch, and Winfred G. Dodson.
Available from the Clearinghouse as PB-193 027, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Project B-367, June 1970. 62 p, 3 tab, 1 fig, 15 ref, append. OWRR Project A-024-GA (1).

Descriptors: *Industrial water use, *Municipal water policy, *Water rates, *Water costs, *Economic impact, *Community development, City planning, Georgia, Economic benefits, Local governments, Political constraints, Public benefits, Social impact, Social values.

Municipal water service policies were investigated in 27 Georgia cities to determine the effect on economic growth in suburban areas. Over 200 new industries located in or near these cities during the period, 1964-1969, of which 45 located outside of the corporate limits of 19 of these cities. Only seven of the 27 cities were judged to have formal consistent water service extension policies. The others lack a consistent policy or have none at all. Lack of consistent water service policies was found to handicap industrial development efforts of the cities and underpricing of water to industry outside the cities was notable. Principal conclusions of the study are: Extension of water service to outside industry is overemphasized and quality of service is seriously underrated; a cheap water policy is not essential to attract industry; cities should establish water rates to fully support outside service including fire protection; water service should be extended to industrial areas that can be annexed; the better municipal services of an industrial location within a city outweigh tax savings of an outside location. (Conway-Georgia Tech)
W70-08420

ATTITUDES AND ATTITUDE CHANGE RELATING TO WATER RESOURCES,
Georgia Inst. of Tech., Atlanta. School of Psychology.
C. Michael York.
Available from the Clearinghouse as PB-193 028, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Apr 1970. 31 p, 47 ref. OWRR Project A-019-GA (1).

Descriptors: *Attitudes, *Social behavior, *Psychological aspects, Social aspects, Motivation, Decision-making process, Scaling, Water resources, Reviews.
Identifiers: *Attitude change, *Credibility variable, *Likert-type attitude scale.

A state of the art review was made of the nature and measurement of attitude in terms of its utility in the water resources field in Task I of a two-task project. Several methods of measurement are discussed to point up the range of approaches and data outcomes available for use among the social and behavioral science community. Task II involves an experimental investigation of the critical variable of source credibility within the attitude change process. An individual's attitude was chosen as the principal index of behavioral tendency. A Likert-type attitude scale was used for 'before-test' data gathering on the issue, fluoridation of a community water supply. The student audience then viewed a widely used public information film which portrayed the advantages of this technological innovation. The film was narrated by Dr. Spock. 'After-test' measures included attitude toward fluoridation and perceptions of the speaker or communication source. Attitudes were observed to be more favorable after the film and the credibility ratings were related positively to the expressed attitude. (Conway-Georgia Tech)
W70-08421

A FEASIBILITY STUDY IN COMMUNICATIONS EFFECTIVENESS: EVALUATING A PERSUASIVE FILM RELATING TO A WATER ISSUE,
Georgia Inst. of Tech., Atlanta. School of Psychology.
C. M. York.
Available from the Clearinghouse as PB-193 021, $3.00 in paper copy, $0.65 in microfiche. Addendum to Report WRC-0569, Water Resources Center, Georgia Institute of Technology, Sept 1969. 20 p, 2 fig, 5 tab, 13 ref, append. OWRR Project No B-024-GA (2).

Descriptors: *Social impact, *Evaluation, *Attitudes, Social aspects, Psychological aspects, Fluoridation, Water treatment, Motivation, Management.
Identifiers: Publicity evaluation, Propaganda, Sociology.

A persuasive film on water supply fluoridation was evaluated by use of attitude questionnaires, discussions, and interviews. In the pilot study among college students, the hypothesis that no significant change in attitude would be observed for the control subjects, who saw no film, was supported by a t-ratio less than unity. The pre-test and retest attitudes (average group scores) were 85.5 and 86.3 respectively, with comparable variability in rating response. Those in the film-only group exhibited a mean score of 81.4 during pre-testing, then expressed a significantly more favorable attitude (88.3) a few minutes after the film, with a significant t-value of 2.95. The 17 persons in the film and discussion group, had slightly higher favorability scores (88.1) prior to the test. Their after-film average was even higher (93.1), revealing a significant shift in attitude, with a t-value of 3.8. Inspection of the delay-scores one month later indicated a uniform reduction in the degree of favorableness. (Knapp-USGS)
W70-08422

PROMOTING AGRICULTURAL DEVELOPMENT,
International Bank for Reconstruction and Development, Washington, D.C.
Dinesh Bahl.
Finance and Development, Volume 7, Number 2, June 1970, p. 38-43, 3 photos.

Descriptors: *Irrigation programs, Land development, *Agronomy.
Identifiers: Food and Agriculture Organization, United Nations Development Programme, Green revolution, Second World Food Congress, International Finance Corporation.

The World Bank has financed agricultural development projects since 1948 but not until the 1960's did this type of assistance account for a substantial percentage of Bank loans. Irrigation projects were one of the first kinds of loan made by the Bank for agricultural development. However, although the number of irrigation construction projects is still numerous and although only 15 to 20 percent of cultivable land in developing countries is irrigated, still the Bank has realized that irrigation is merely the first step toward increased agricultural development. Extending credit loans, financing extension services and assisting fertilizer plant construction are becoming important Bank concerns as well. (Holmes-Rutgers)
W70-08427

SOCIO-ECONOMIC SIMULATION FOR WATER RESOURCE SYSTEM PLANNING,
Department of Energy, Mines and Resources, Ottawa (Ontario).
Peter J. Reynolds, and Asit K. Biswas.
13th Congress International Association Hydraulic Research Proceedings, Vol 1, p 75-82, Aug-Sept 1969. 8 p, 1 tab, 21 ref.

Descriptors: Water resources, Water resources development, *Economic feasibility, *Simulation, River basin development, *Social aspects, Mathematical models, *Models, Economics, Ecology, Effects, *Sociology, Human resources, Decision making, Bibliographies, Evaluation, Planning, Multiple-purpose projects, Reviews, Policy matters.
Identifiers: Regional planning, Human relations, Canada, Alternatives.

The current status of socio-economic simulation in water resource planning is reviewed. Efficient allocation of limited national resources among a variety of competing government programs can be achieved only by measuring their relative cost-effectiveness. This can be done by evaluating social, political, and economic effects on human beings. Until national and basin socio-economic models are available, evaluating alternative public policy programs on disparate regions and distinct socio-economic groups would be difficult for policy planners. The state of the art in socio-economic modeling has advanced sufficiently to be useful in water resource policy planning and decisionmaking. Modeling also gives the analyst a better insight into the various interactions within the complex processes, and will point out methods for dealing with the socio-economic phenomena associated with water resource system design. Up to now, ecology has not been considered. If water resource policy planning is to be more effective, a comprehensive system must be developed incorporating the interdependence of a multi-region, socio-ecologic system that would allow more satisfactory sets of policy alternatives to be evaluated. (USBR)
W70-08453

WATER RESEARCH SUMMARY.
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 09D.
W70-08473

THE ARIZONA WATER CONTROVERSY: AN ECONOMIST'S VIEW,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
Robert A. Young.
Journal of the Arizona Academy of Science, Vol 6, No 1, p 3-10, March 1970. 16 ref.

Descriptors: *Cost-benefit analysis, *Water demand, *Arizona, *Economic justification, *Economic impact, Water costs, Water allocation (Policy), Water distribution (Policy), Administrative agencies, Competing uses, Equitable apportionment, Irrigation practices, Irrigation programs, Water resources development, Water supply, Water utilization, Benefits, Costs, Planning, Productivity, Project feasibility, Employment, Social impact, Budgeting, Wages, Value.
Identifiers: *Central Arizona Project, *Direct value of water, Marginal economic sectors.

For the past 2 decades water policy planners in Arizona have assumed that state economic well-being and growth is crucially dependent on augmented water supplies. However, during the same period, and without augmented water supplies, the state has registered growth rates of 200-600 percent. Returns per unit of water intake are 16 dollars per acre foot in the grain and forage sector and 80,000 dollars per acre foot in the manufacturing sector. The nonagricultural sectors of the economy have increased about ten-fold since World War II, and there is much evidence to indicate that agriculture has at least held constant, despite many assertions to the contrary. A cost-benefit analysis of the Central Arizona Project estimates that added returns to the state will be considerably less than one-half the associated cost, causing hardships for the large non-agricultural proportion of the economy. It is concluded that: (1) Agriculture is a marginal sector contributing relatively little to the state economy, and is unimportant to future economic growth (2) Current water resources are adequate for projected growth in the non-agricultural sector (3) The projected benefit-to-cost ratio does not justify a water augmentation scheme and could lead to large losses of public funds. (Casey-Arizona)
W70-08532

ENVIRONMENTAL THREAT AND SOCIAL ORGANIZATION,
International Union of Anthropological and Ethnological Studies.
Lawrence Krader.
The Annals of the American Academy of Political and Social Science, Vol. 389, May 1970, p 11-18. 7 ref.

Descriptors: *Social values, *Environment, Management, Costs, Attitudes.
Identifiers: *Social organization, *Environmental threat, Society, Policy, Environmental problems, Ecology of abundance, Ecology of scarcity.

The mental approach of the natural scientist to the study of the physical environment contrasts with the social science approach. The unit of study is the same: in both cases it is the society, but instead of value-free adaptations (of the natural sciences), the social sciences tend to evaluate environmental relations as beneficent or dangerous to man. American society has its adaptive niche on the North American continent, but in its brief history, we note a change in attitude from the first settlers' confident belief that nature will provide for mans wants, to our present sense of the threat to social existence generated by environmental problems. This is coupled with a growing conviction that past policies of uncontrolled depletion have brought about the change from an ecology of abundance to an ecology of scarcity. We are passing through a climacteric at present regarding quantity and quality of water supply, and as we change our philosophy of natural resources generally, so do we change our management policies toward them in particular. We are making up our minds that what was cheap or free will now become expensive. The pills of rising costs and taxes are a bitter dosage. (Davis-Chicago)
W70-08543

SOCIETY AND ITS PHYSICAL ENVIRONMENT.
American Academy of Political and Social Science.

Annals of the American Academy of Political and Social Science, Vol. 389, May 1970.

Descriptors: *Enviroment, *Social aspects, *Management, *Planning, Economics, Legal aspects.
Identifiers: *Metropolitan water resource management, Environmental threat, Environmental usufruct.

Numerous aspects of the relationships between society and its physical environment are explored. Among the general topics discussed are: the nature of environmental threat; society, personality, and environmental usufruct; the economics of common environmental property; emerging environmental law; and organizing for environmental planning. A number of larger issues that are basic to metropolitan water resource management are examined in this collection of articles. (Davis-Chicago)
W70-08544

THE CHARISMATIC AND THE PLAYFUL IN OUTDOOR RECREATION,
City Univ. of New York.
Rolf Meyersohn.
Annals of the American Academy of Political and Social Science, Vol. 389, May 1970, p 35-45. 1 tab, 46 ref.

Descriptors: *Recreation, *Social aspects, Social values.
Identifiers: *Charisma, Play.

cking parallels exist between the concepts arisma and play. Both refer to a quality or an entation rather than a behavior or an activity. th are seen as innate to humans, yet scarce ause of lack of opportunity and lack of cultiva-n, as well as lack of talent or 'genius'. Charisma well as play is related to vital processes and is nscendent, featuring the extraordinary. arisma and play are contrasted with the routine l reject it. Separateness and segregation are in-ent in charisma and play; yet both become rou-zed, stylized, institutionalized. The elaborate l complex nature of these concepts is illustrated examining a study of wilderness-camping in ich qualities of experience are expressed that n be derived from the elements of charisma and y. These qualities are more readily experienced persons who are trained to experience them; st leisure-activities are not felt to be so moving touching, and outdoor recreation as well as the t of the activities which occupy us during our e time are not usually endowed with transcen-nt qualities. (Davis-Chicago)
70-08546

DAPTATION UNDER EXTREME ENVIRON-ENTAL CONDITIONS,
nnsylvania Univ., Philadelphia.
eorge E. Ruff.
nnals of the American Academy of Political and cial Science, Vol. 389, May 1970, p 19-26. 1 fig, ef.

escriptors: *Environment, Equilibrium, Ecology, ress.
entifiers: *Adaptative mechanisms, *Systems, edback mechanisms.

ving systems tend to maintain in equilibrium vari-les associated with their continued existence. En-ronmental conditions which force these variables eyond their normal ranges produce stress within e system. Feedback mechanisms then seek to store equilibrium. Stress arises from overloads or nderloads of energy and information, as well as om inputs which have threatening implications. he process of adapting to stress depends partly on e nature of the stress-producing agent and partly n the mechanisms available to the system. When e system is subjected to extreme environmental onditions for an extended period of time, adapta-ve responses may become increasingly costly. A ossible outcome is one of the 'diseases of adapta-on.' Eventually, adaptative mechanisms may fail nd the system may collapse. The stress encoun-ered by most individuals arises from the symbolic, ather than the physical, aspects of their environ-ent. Further, most studies of men under stress eveal a remarkable capacity for adaptation to ex-eme environments. (Davis-Chicago)
V70-08547

5D. Water Demand

CLIMATIC ESTIMATES OF AVERAGE AND PROBABLE IRRIGATION REQUIREMENTS AND OF SEASONAL DRAINAGE IN CANADA,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
For primary bibliographic entry see Field 03F.
W70-08216

ECONOMIC GUIDELINES FOR LAND AND WATER RESOURCE USE IN AGRICULTURE,
Alberta Univ., Edmonton. Dept. of Agricultural Economics.
Travis W. Manning.
Canadian Journal of Agricultural Economics, Vol. 17, number 3, November 1969, p 1-8. 13 ref.

Descriptors: *Water allocation (Policy), Recrea-ion demand, Resource allocation, Economics, *Water demand.
Identifiers: *Federal Task Force on Agriculture, Economic Council of Canada.

Agriculture in Canada is faced with growing problems of overproduction, low farm incomes and too many farmers. The author discusses non agricultural uses of land and water resources, stressing particularly recreational uses. Although many of the factors considered in land and water allocation are the same, water resource use is more economically calculable and can be measured as a capital input more readily. Nonetheless the effects of water resource development projects may be as difficult to reverse as land use projects. Therefore, the author urges more careful consideration of the benefits and disadvantages of new water resource development particularly in western Canada. (Holmes-Rutgers)
W70-08432

REPORT TO THE REGIONAL PLANNING COUNCIL, BALTIMORE, MARYLAND ON A PLAN FOR REGIONAL WATER SUPPLY TO THE YEAR 2020, VOLS. I, II.
Hazen and Sawyer, New York.

Financial assistance provided by HUD under Section 701 of the Housing Act of 1954. June 1969.

Descriptors: *Water demand, *Water supply, *Water works, *Water distribution, *Water treatment, *Municipal water, *Cities, *Planning, *Water resource development, *Comparative costs, *Water shortage, *Reservoir sites, Urbanization, Long term planning, Future planning, Capital costs, Construction costs, Forecasting, Waste water treatment, Water reuse.
Identifiers: *Baltimore, *Potomac River, *Susquehanna River, Baltimore Regional Planning Council.

This two-volume report to the Baltimore Regional Planning Council presents findings and recommendations resulting from a study of the water supply needs, to the year 2020, of the City of Baltimore and the counties of Anne Arundel, Baltimore, Carroll, Harford and Howard. The engineers estimated that the present 2 million population will grow to 4.8 million persons by the year 2020. Average water demands on public systems, including industrial requirements, are expected to increase from 265 mgd to 900 mgd during the period. Maximum-day water demands in various parts of the service area will range from 40 to 70 per cent more than average use. The average water deficit by the year 2000 is estimated at 120 mgd, and 350 mgd by the year 2020, if water supply capacities are not increased. The sources of water supply best suited to regional development are the Susquehanna River at Conowingo, Deer Creek in Harford County, and the Potomac River. Conversion of sea water and reclamation of sewage and industrial wastes are not recommended because of high costs and lower quality. Volume I of the publication contains the main text and recommendations. Volume II contains 12 appendices which serve as documentation. (See also W70-07848 and W70-07849) (Poertner)
W70-08437

REPORT TO THE REGIONAL PLANNING COUNCIL, BALTIMORE, MARYLAND ON A PLAN FOR REGIONAL WATER SUPPLY TO THE YEAR 2020, VOL. I-MAIN TEXT.
Hazen and Sawyer, New York.

Report, June 1969. 180 p, 25 fig, 23 tab.

Descriptors: *Water demand, *Water supply, *Water works, *Water distribution, *Water treatment, *Municipal water, *Cities, *Planning, *Water resource development, *Comparative costs, *Water shortage, *Reservoir sites, Urbanization, Long term planning, Future planning, Capital costs, Construction costs, Forecasting, Water reuse.
Identifiers: *Baltimore, *Potomac River, *Susquehanna River, Baltimore Regional Planning Council.

Water supply requirements and recommendations for facilities to the year 2020 are detailed in this report to the Baltimore Regional Planning Council. The service area includes the city of Baltimore and its five contiguous counties. The engineers made the following recommendations: (1) develop a 570 mgd water supply from both the Potomac and Susquehanna Rivers, and enlarge the W.S.S.C. Triadelphia Reservoir from 7 to 40 billion gallons; (2) promptly acquire land on Deer Creek for the Darlington Reservoir; (3) negotiate with the Washington Suburban Sanitation Commission regarding the purchase or lease of Triadelphia Reservoir and acquire land for enlargement (if negotiations fail, purchase the Gillis Falls site); (4) Carroll County should acquire sites for the proposed new Windsor Reservoir (in addition to Piney Run and Union Mills), and a 5 billion gallon reservoir on Gillis Falls if the latter is not used for the central supply system; (5) detailed engineering and comparative cost studies should be made to permit prompt acquisition of land and rights-of-way for (a) treatment plants and sludge disposal, (b) transmission main routes, and (c) ground storage reservoirs; and (6) adequate staff and funds should be made available soon. (See also W70-08437) (Poertner)
W70-08438

REPORT TO THE REGIONAL PLANNING COUNCIL, BALTIMORE, MARYLAND ON A PLAN FOR REGIONAL WATER SUPPLY TO THE YEAR 2020, VOL. II-APPENDICES.
Hazen and Sawyer, New York.

Report, June 1969. 114 p, 33 fig, 35 tab, 81 ref.

Descriptors: *Water demand, *Water supply, *Water works, *Water distribution, *Water treatment, *Municipal water, *Cities, *Planning, *Water resource development, *Comparative costs, *Water shortage, *Reservoir sites, Urbanization, Long term planning, Future planning, Capital costs, Construction costs, Forecasting.
Identifiers: *Baltimore, *Potomac River, *Susquehanna River, Baltimore Regional Planning Council.

This publication contains 12 detailed appendices that serve as documentation for Volume I which presents estimates of the water supply requirements of Baltimore and its 5 contiguous counties to the year 2020. The following appendices are included: (A) Hazen and Sawyer Memorandum of May 16, 1968 to the Baltimore Regional Planning Council, which includes population projections by Johns Hopkins University, Maryland State Planning Department, Hammer and Company, Baltimore Regional Planning Council, National Planning Association, and the U. S. Department of Commerce; (B) Baltimore Regional Planning Council Population Forecasts; (C) Comparison of Population Forecasts With Forecasts By Others; (D) Hazen and Sawyer Water Consumption Forecasts; (E) Hazen and Sawyer Industrial Water Memorandum, dated November 1968; (F) Hydrology of Existing Baltimore Watersheds; (G) Basis of Cost Estimates; (H) Project Reservoirs; (I) Susquehanna Basin Date; (J) Potomac Basin Data; (K) Project Phasing For High and Low Population Forecasts; and (L) Bibliography. The appendices contain discussions together with many tables and figures. (See also W70-08437) (Poertner)
W70-08439

THE ARIZONA WATER CONTROVERSY: AN ECONOMIST'S VIEW,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 06B.
W70-08532

6E. Water Law and Institutions

ETHNOHISTORY AND CONTEMPORARY UNITED STATES SOCIAL PROBLEMS,
Kentucky Univ., Lexington.
Henry F. Dobyns.

Available from the Clearinghouse as PB-192 761, $3.00 in paper copy, $0.65 in microfiche. Paper presented at 17th Annual Meeting, American Society of Ethnohistory, Ithaca, New York, October 24, 1969. 22 p, 1 tab, 36 ref. OWRR Project A-022-KY (2)

Descriptors: *Social change, *Social impact, *History, Kentucky, Dams, Drainage systems, Regulated flow, Ecological distribution, Community development.
Identifiers: *Ethnohistory, *Anthropological data, *Social benefits, *Cultural benefits.

Research was initiated by anthropologists in three study units in Kentucky to ameliorate critical social conditions. The research was based on three basic policy assumptions: (1) a society can only afford to finance science activity whose findings can be utilized; (2) anthropologists should be aware of the policy implications of their research; and (3) the anthropologist theory should withstand the test of application to practical problems. The research objective was to compile cultural data for a baseline description of the units being studied in 1969-1970 before stream-control measures are taken. Future research in this project is aimed at measuring cultural change produced by these stream-control measures. The theory of community development is being tested; research has uncovered evidence that there is competition between settlements in Kentucky for population and institutions. Subcultural difference implying historical divergence exist between members of one ethnic group in counties within even a limited portion of a single state. The study of water use and management in these study areas in Kentucky focuses upon historic cycles in ecological influences. (Starr-Chicago)
W70-08151

INSTITUTIONAL FACTORS AND THE TEXAS WATER PLAN,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Sociology; and Texas A and M Univ., College Station. Water Resources Inst.
Warren L. Trock, and Clarence W. Jensen.
Water Resources Bulletin, Vol 6, No 2, p 261-268, March-April 1970. 8 p, 21 ref. OWRR Project No B-025-TEX.

Descriptors: *Water resources development, *Planning, *Water law, *Institutions, *Mississippi River, Legislation, River basin development, Water allocation (Policy), Water transfer, Inter-basin transfers, Water rights, Interstate, Interstate rivers.
Identifiers: Texas Water Plan.

Among the many problems associated with the implementation of the Texas Water Plan are the institutional arrangements necessary for interstate diversions, for management of transfer systems, for allocation and sale of water, and for developing repayment capabilities among water users. To make a transfer system functional, a diversion in perpetuity is necessary. There will be important private and public resistance to diversion from the Mississippi because (1) it is navigable for a good portion of its length, (2) its waters are shared by several states, (3) there is considerable economic dependence on the stream, (4) it has significant subjective value and (5) other considerations create demands for maintenance of the river in its present state. (Knapp-USGS)
W70-08188

DAVIDSON V VAUGHN (CONVEYANCE OF A RIGHT TO WITHDRAW WATER FROM A NATURAL WATERCOURSE).

44 A2d 144-149 (Vt 1945).

Descriptors: *Vermont, *Streamflow, *Usufructuary right, *Water sources, Discharge (Water), Water management (Applied), Diversion, Judicial decisions, Legal aspects, Routing, Bypasses, Diversion structures, Springs, Fresh water, Water supply, Relative rights, Contracts, Water users.

Plaintiff and defendant, adjacent land owners, entered into an agreement in which defendant granted to plaintiff a perpetual right to tap a spring and the brook flowing therefrom, and to convey the water from said spring and brook by suitable means. Plaintiff was building a cottage on his land and was taking lawful advantage of his agreement with defendant when his house was destroyed. He constructed a larger house at a higher elevation and, to utilize the spring water, he had to build a spring house and draw water from the brook, instead of the spring, as had previously occurred. Defendant attempted to prevent plaintiff's use of the water. Plaintiff brought suit to restrain defendant's acts. The court held that conveyance of a perpetual right to tap a spring and brook is not limited as to place or method, and a grantee's right to take water is not limited to the place where the water was being taken from at the time the conveyance was executed. Consequently plaintiff had the right to take the water directly from the spring or from any part of the brook that issues from it. (Barnett-Florida)
W70-08190

TAIT V FIRST FEDERAL SAVINGS AND LOAN ASS'N (SUIT TO RESTRAIN INTERFERENCE WITH WATER RIGHTS).
132 N J Eq 493, 28 A2d 764-765 (1942).

Descriptors: *New Jersey, *Easements, *Pipelines, *Reservoir storage, Water supply, Judicial decisions, Legal aspects, Wells, Water wells, Reservoirs, Domestic water, Water demand, Pipes, Distribution systems, Land tenure, Real property, Relative rights.
Identifiers: Grants (Deeds).

Suit was brought by complainant to restrain threatened interference with water rights granted to her. Complainant was the grantee of land adjacent to land held by her grantor. The deed from grantor to complainant contained a grant of water rights in an existing water supply on the grantor's land. The grant permitted the running of pipes across the grantor's land to conduct the water. Two years after the grant the source of water supply was changed by the grantor from a reservoir to a well, to which complainant connected her pipes under an oral agreement with grantor. Defendant took a mortgage on the grantor's lands with constructive knowledge of complainant's easement and rights in the water. Defendant contended that the easement that did exist was terminated by a change in the source of supply. The court found this contention unsound since it placed too narrow a construction on the deed and did not take into consideration the facts and circumstances involved. At the time of the execution of the mortgage, the grantor would have been estopped from interfering with complainant's rights to obtain water since by his own acts he had cut off the reservoir supply. This estoppel extended to defendant mortgagee. (Barnett-Florida)
W70-08192

HANSEL V COLLINS (RELATIVE RIGHTS OF ADJOINING LANDOWNERS IN WATER PIPELINE).

23 A2d 686-690 (Md 1942).

Descriptors: *Maryland, *Prescriptive rights, *Easements, *Pipelines, Land tenure, Boundaries (Property), Real property, Legal aspects, Compensation, Water supply, Domestic water, Relative rights, Water demand, Water utilization, Judicial decisions.
Identifiers: *Injunction.

Plaintiff and defendant held adjoining tracts of land from a common grantor. Defendant's predecessor in title had constructed to his house a water pipeline which ran across a corner of plaintiff's land. Defendant's predecessor in title granted to plaintiff's predecessor in title permission to use water from the line. Defendant subsequently demanded that plaintiff either pay for use of the water or disconnect from the pipeline. When plaintiff refused, defendant began to construct a pipeline around plaintiff's property. Plaintiff sought to enjoin interference with his use of the line. Defendant asked an injunction against plaintiff's use. The court held for defendant stating that, since plaintiff's predecessor in title had not contributed to the cost of constructing the line nor given permission for it to cross his land, plaintiff could not claim co-ownership of the line as a successor in interest. An implied grant of easement could not be found since the common grantor had conveyed plaintiff's estate after conveying defendant's estate and there had been no express reservation of an easement over plaintiff's land. A prescriptive right to use the pipeline could not be claimed since the water had not been taken adversely for a 20 year period. (Hubener-Florida)
W70-08199

TOY V ATLANTIC GULF AND PACIFIC (LIABILITY FOR FILLING OF CREEK BED).

4 A2d 757-767 (Md 1939).

Descriptors: *Maryland, *Dredging, *Accidents, *Access routes, Engineering structures, Channel improvement, Excavation, Embankments, Concrete structures, Damages, Obstruction to flow, Riparian rights, Beds under water, Navigable waters, Ownership of beds, Navigation, Transportation, Fishing, Collapse, Buckling, Weirs, Canal construction, Failure (Mechanics), Canals, Judicial decisions, Legal aspects, Fish farming.
Identifiers: *Negligence.

Plaintiffs owned land along a certain creek. Plaintiffs controlled the entry of water from the creek into a ravine, in which they raised carp, by operation of a weir. Defendant dredging company deposited large quantities of dredged earth along the creek near plaintiffs' tract of land and constructed an embankment to confine the excavated material. The embankment gave way sending large quantities of earth into the creek and cutting off access by water to plaintiffs' ravine. Plaintiffs sued for damages. The court acknowledged that although water in the creek was shallow and plaintiffs held no title to the creek bed below the high water mark, they were entitled as riparian proprietors to enjoy such floatage as the creek would provide. Deposits placed in the channel impeding its use were unlawful. However, the court gave judgment for defendant, holding that the mere happening of the accident did not prove negligence. The exercise of reasonable care could not have ascertained a defect in the embankment structure, and res ipsa loquitur did not apply since defendant was not shown to be at fault. Liability without fault did not apply since defendant did not own or occupy the site of the deposits. (Hubener-Florida)
W70-08206

CHAPMAN V DELK (LOSS OF MILL-DAM FLOODING EASEMENT DUE TO OPERATION OF STATUTE).

16 SE2d 379-383 (Va 1941).

Descriptors: *Virginia, *Easements, *Mill dams, *Flooding, Ponds, Confined water, Legal aspects, Judicial decision, Impounded waters, Water levels, Water level fluctuations, Surface waters, Dams, Water control, Eminent domain, Mills, Relative rights, Legislation, Compensation, Lakes, Land tenure, Real property.
Identifiers: Statutes of limitation.

The complainants owned land adjacent to a mill pond. The defendant held an easement to flood lands above a dam on the pond. After the mill had been out of use for forty years, the defendant sought to raise the level of the pond by five feet and to further flood the land of the complainants. Complainants sued to terminate the defendant's right to do so. The mill pond, a dam and grist mill had been developed between 1836 and 1856 pursuant to a

tate statute. The statute provided that under cer-ain conditions private property could be taken to establish a grist mill. A forfeiture provision of the tatute stated that if the mill were destroyed or endered useless, and repairs not begun within two ears, the title to the land would revert to the riginal owner, their heirs or assigns. The appellate ourt held that as the mill had been abandoned for orty years, the title reverted to the original owners nd the easement to flood lands extinguished. Price-Florida)
W70-08264

COGSDALE V HOWARD (DISPUTE TO TITLE OF POND).

95 SE 514-516 (Va 1938).

Descriptors: *Virginia, *Beds under water, Ownership of beds, *Easements, Lake beds, Land enure, Boundaries (Property), High water mark, Legal aspects, Lakes, Boundary disputes, Mill lams, Artificial use, Real property, Judicial deci-ions, Relative rights, Prescriptive rights, Mills, Ponds.

Plaintiff and defendant disputed ownership of a millpond. Plaintiff owned a grist mill and mill dam situated on the pond, and claimed the pond on the basis of words in the deed from his grantor which allegedly conveyed to him the real estate 'being the same purchased by grantor.' The grantor had purchased title to the pond but the pond was not specifically mentioned or described in the deed of conveyance. Defendants claimed ownership of the pond as heirs at law of the grantor. The court held for defendants stating that plaintiff had never acquired title to the mill pond either by purchase or adverse possession. The 250 acre pond was not appurtenent to the grist mill or to plaintiff's small tract of land. Plaintiff held only an easement in the water of the pond for the purpose of operating the grist mill. (Hubener-Florida)
W70-08325

SUTTON V TERRETT (ACCRETIONS AS INCIDENT TO RIPARIAN OWNERS WHOSE GRANT RUNS ONLY TO STREAM BANK).
301 Ky 506, 192 SW2d 382-385 (Ky 1946).

Descriptors: *Kentucky, *Accretion (Legal aspects), *Boundary disputes, *Boundaries (Property), Riparian rights, Judicial decisions, Legal aspects, Water law, Bank erosion, Acreage, Alluvial channels, Navigable waters, Streams, Ownership of beds, Riparian land, Rivers, Mississippi River, Channels, Relative rights, Land tenure, Real Property.

Twenty-one years prior to this action, a homestead which bordered on the south bank of a dual-channeled river was divided into seven tracts. The tracts were allotted to seven of nine heirs of the deceased owner. Subsequent to this division, the south channel of the river shifted north, causing land to accrete to the south bank, Plaintiffs, three heirs of the deceased (two of which had not participated in the earlier division), brought action to force the sale of the accreted land. Deed descriptions in the grant of the seven tracts ran only to the bank of the stream, and plaintiffs contended that the accreted and did not therefore affix to the original tracts. Plaintiffs argued that each of the nine heirs owned an undivided one-ninth interest in the accreted and. The lower court so held. In reversing, the appellate court held that, generally, where a line of a grant runs to the bank of a stream and along the stream or the bank, the grant extends to the thread of the stream. Unless the description clearly excludes the space between the bank and the stream thread, all accretions belong to the riparian owner. Consequently, the seven heirs who received land along the river were entitled to the additional land which accreted to their respective tracts. (Marsee-Florida)
W70-08361

HOLYOKE WATER POWER CO V WHITTING AND CO (RESPECTIVE RIGHTS IN STREAM).
276 Mass 528, 177 NE 568-574 (1931).

Descriptors: *Massachusetts, *Mills, *Water users, *Water distribution (Applied), Judicial decisions, Legal aspects, Power head, Hydraulic structures, Water works, Canals, Pipes, Water conveyance, Water supply, Water demand, Flumes, Cavitation, Diversion structures, Dams, Riparian rights, Waterfalls, Water wheels, Diversion.

This dispute arose between plaintiff and defendant over their respective rights to the use of water and water power developed from a waterfall in the Connecticut River. Plaintiff was the owner of a hydraulic system which created water power for manufacturing purposes to be sold or leased to corporations such as defendant. Defendant was the grantee of a mill site with appurtenant water power privileges. Plaintiff alleged that defendant abused such privilege by using more than its alloted mill power and by diverting certain waters in excess of that allowed. The court held for plaintiff, and found defendant had abused its rights in the water without authority. (Barnett-Florida)
W70-08370

BIXBY V BACKUES (OWNERSHIP OF ACCRETED LANDS).
144 SW2d 112-115 (Mo 1940).

Descriptors: *Missouri, *Accretion (Legal aspects), *Boundaries (Property), *Banks, Judicial decisions, Legal aspects, Meanders, River beds, Surveys, Boundary disputes, Patents, Riparian rights, Shores, Coasts, Alteration of flow, Diversion, Relative rights, Real property.

Deeds were entered into evidence by plaintiff which purported to convey certain lands east of the Gasconade River. A controversy arose over ownership of the land evidenced in those deeds. These lands consisted of a three acre tract which was created by a change in the river's course. This change in direction was proven to be slow, gradual and imperceptible, and the lands in controversy were found to be formed by accretion to the shore land. The court stated that, under Missouri law, such accreted land belongs to the owner of the shore land to which it attaches. The deed of the shore land to plaintiff did not contain any exceptions or reservations as to accretions. It therefore presumptively carried with it all accretions so formed. As to the land in controversy, the court found title to be in plaintiff as lands accreted to shore land in which plaintiff had good title. (Barnett-Florida)
W70-08393

THE NATIONAL WATER COMMISSION,
National Water Commission, Arlington, Va.
Theodore M. Schad.
Water and Wastes Engineering, Vol 6, No 8, p 38, August 1969.

Descriptors: *Water policy, Water quality, *Water resources development, Water law, *Planning, Institutions, *Organizations, Administrative agencies.

The goals and objectives, membership, staff and organization of the National Water Commission are presented. The seven man commission was established by Public Law 90-515 and is to undertake a five year study of water resource problems in the US, the purpose of which is to provide background for policy recommendations to guide the future activity in water related fields in the US. The information will be obtained by the commissions staff, from state and federal agencies, and private organizations. The studies will encompass many water-related areas. The commissions final report to the President and Congress is due September 1973. A listing of the commission members, key staff members, and special consultants is also included. (Makela-Texas)
W70-08406

EFFECT OF MUNICIPAL WATER SERVICE POLICIES ON ECONOMIC GROWTH IN SUBURBAN AREAS,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
For primary bibliographic entry see Field 06B.
W70-08420

ATTITUDES AND ATTITUDE CHANGE RELATING TO WATER RESOURCES,
Georgia Inst. of Tech., Atlanta. School of Psychology.
For primary bibliographic entry see Field 06B.
W70-08421

STATE V HOLLAND (DIFFERENCE BETWEEN PUBLIC AND SOVEREIGN LAND).

10 So2d 577-592 (Fla 1942).

Descriptors: *Florida, *Ownership of beds, *Land classification, *Public lands, State governments, Local governments, Cities, Legal aspects, Judicial decisions, Legislation, Water law, Remedies, Regulation, Navigable waters, Classification, Land, Land use, Real property, Property values.

The State of Florida, on behalf of Crescent City, Florida, sought to compel the Trustees of the Internal Improvement Fund to convey certain lands to such city. Whether the city was to pay a nominal sum or a substantial price for these lands depended upon the determination of the issue of whether these lands were public lands or soverign lands. If designated as public lands, such realty would sell for a substantial sum, as opposed to the more nominally priced sovereign lands. The court stated that public lands are those which are owned by the state, subject to sale or disposition under general law, and those which have not been reserved for any partiuclar purpose. However, the court further noted that lands under navigable waters below the ordinary high water mark belong to the state, by virtue of its sovereignty for appropriate uses, and are not among the public lands of the state. The court held that the lands which were the subject of controversy were sovereign lands, which necessarily entailed conveyance for a nominal fee as authorized by state law. (Finman-Florida)
W70-08440

LAW V GULF STATES STEEL CO (DAM NOT THE PROXIMATE CAUSE OF UPLAND FLOODING).
175 So 322-326 (Ala Ct App 1937).

Descriptors: *Alabama, *Dams, *Flood damage, *Headwaters, Damages, Flash floods, Flooding, Overflow, Flood water, Judicial decisions, Floods, Backwater, Streams, Watersheds (Basins), Concrete dams, Structures, Crops, Legal aspects, Adjudication procedure, Water levels.
Identifiers: *Causation (Legal aspects).

In an action for damages, plaintiff contended that his crops were destroyed by backwater overflow from a creek dammed by defendant. Defendant contended that plaintiff's crops were damaged by a flood flowing from above and not impeded by the dam. Defendant argued that the headwaters rushing down the creek reached such a height that the crops would have been destroyed even if the dam had not existed. The appellate court held that evidence introduced to the jury for the purpose of showing the area's topography, elevations, and probable rise of water was properly admitted. The jury's determination that the dam was not a proximate cause of the destruction of plaintiff's crops was affirmed. (Snow-Florida)
W70-08444

WATER ADMINISTRATION--A SUGGESTED INSTITUTIONAL MODEL,
Nebraska Univ., Lincoln. Dept. of Agricultural Economics.
Clayton K. Yeutter.

Available from the Clearinghouse as PB-193 024, $3.00 in paper copy, $0.65 in microfiche. University of Nebraska, Department of Agricultural Economics Report No 46, December 1968. 30 p, 74 ref. OWRR Project No A-008-NEB.

Descriptors: *Institutions, *Administration, *Water resources development, Institutional constraints, Political aspects, Decision making, Local governments.
Identifiers: *Water administration, *Institutional model, Water resources board, Comprehensive water plan, Externalities, Proctored market, Local water administrative agencies.

An institutional model for water administration is described which attempts to provide a basic, general framework of almost universal applicability, through the provision of the skeletal components of a water code featuring simplicity, flexibility, and localized responsibility. This institutional proposal is pyramidal in approach. At the peak is a Water Resources Board that will: (1) develop a comprehensive water plan for the state; (2) make broad policy decisions in both planning and administrationp (3) deal with water problems that are state-wide in scope; and (4) coordinate the activities of local water administrative agencies. Local organizations form the base, including streamflow, groundwater, and reservoir districts and with various combinations thereof. This institutional model might be considered a 'proctored market' model whose institutional model might be considered a 'proctored market' model whose intent is to: (1) permit most, but not all, water allocation decisions to be made by the market; (2) proctor, alter, or pre-empt the market only with respect to functions that the market cannot satisfactorily perform; and (3) localize non-market decision-making responsibilities whenever feasible. The market will not, however, resolve all the ills of water administration, hence, the need for centralized agencies designed to cope with these 'externalities'. (See also W69-08115) (Davis-Chicago)
W70-08462

THE RIO GRANDE COMPACT,
S. E. Reynolds.
In: International Law Along the Mexican, American Border, No 11, Committee on Desert and Arid Zones Research, Southwestern and Rocky Mountain Division, A.A.A.S., p 48-64, 1968.

Descriptors: *Rio Grande, *New Mexico, *Federal jurisdiction, Surface waters, Groundwater, Dams, Reservoirs, Texas, Colorado, Irrigation canals, Irrigation districts, Irrigation permits.
Identifiers: *Federal legislation, *U.S. Supreme Court, *Rio Grande Compact, *Interstate compacts, *Doctrine of equitable apportionment, Debit water, Elephant Butte Reservoir, Rio Grande Valley

In adjudicating interstate water controversies, the U.S. Supreme Court applies the doctrine of equitable apportionment between upstream and downstream western states. A number of other economic and social factors are also involved in the Court's deliberations and the bases of decisions may be extremely involved. Alternatively, such controversies may be resolved by federal legislation throught the creation of water compacts. It is generally agreed that compacting best resolves interstate water controversies. The Rio Grande Compact of 1938 effectively established requirements and standards for the apportionment of Rio Grande Waters between New Mexico, Colorado and Texas. Three generally misunderstood aspects of the Compact are clarified. (1) The amount of water delivered between states in any given year is determined by water gauges at each supply level (2) The Compact does not effectively apportion water between New Mexico and Texas but between 2 parts of New Mexico (3) Accrued water debits do not reflect New Mexico's contributions because much of it was temporarily created by long-term water supply improvement projects within the state (Casey Arizona)
W70-08520

HITE V TOWN OF LURAY (CONSTRUCTION OF DEEDS AND ASCERTAINMENT OF WATER RIGHTS).

8 SE2d 369-373 (Va 1940).

Descriptors: *Virginia, *Springs, *Water users, *Patents, Cities, Legal aspects, Judicial decisions, Reasonable use, Alteration of flow, Municipal water, Natural flow doctrine, Obstruction to flow, Relative rights, Prior appropriation, Damages, Riparian rights, Riparian land, Riparian waters, Streams, Mills, Saw mills, Pipes, Easements, Condemnation, Public health.

Plaintiff city brought suit for the construction of certain deeds to determine what rights it had acquired in and to certain springs and the waters flowing therefrom. Certain mesne conveyances were examined which conveyed the property in question but which reserved certain water rights in the original grantor. The court concluded that plaintiff owned a property right in all the water in the spring except so much as was reserved in the original conveyances by the grantor, including: (1) the right to withdraw from the spring specified amounts of water; and (2) the right to the use of so much of the water flowing from the spring as might be necessary to meet the ordinary needs of the owner of the lands through which it passes. Those rights and privileges granted and reserved were found to be appurtenant to and running as covenants with the land as granted in the original conveyance. (Barnett-Florida)
W70-08525

MAJOR UNITED STATES WATER PROBLEMS ALONG THE INTERNATIONAL BOUNDARY REACH OF THE RIO GRANDE (BRAVO),
International Boundary and Water Commission, El Paso, Tex. Office of Water Control.
For primary bibliographic entry see Field 03B.
W70-08539

EMERGING LEGAL STRATEGIES: JUDICIAL INTERVENTION,
Michigan Univ., Ann Arbor.
Joseph L. Sax.
The Annals of the American Academy of Political and Social Science, Vol. 389, May 1970, p 71-76. 8 ref.

Descriptors: *Legal aspects, Management, Natural resources, Attitudes, Social values, Decision making.
Identifiers: *Legal strategy, *Judicial intervention, Environmental litigation, Policy.

Citizen-initiated environmental litigation is a response to the inability of traditional administrative agencies to accommodate to newly recognized ecological perspectives in the management of natural resources. Old-line agencies, freighted by singled-mindedness, a particular sense of mission and alignment with limited constituencies, are often unequal to the broadened perspectives which modern legislation and new public attitudes demand of them. Consequently, important policy decisions are undermined or distorted. Judicial assistance is sought to return important policy decisions to a forum in which democratic processes work more effectively. One such incipient technique is the judicial 'remand' of administrative action to the legislatures. (Davis-Chicago)
W70-08542

ENVIRONMENTAL PROBLEMS AND LEGISLATIVE RESPONSES,
National Air Pollution Control Administration, Arlington, Va.
Jack C. Oppenheimer, and Leonard A. Miller.
Annals of the American Academy of Political and Social Science, Vol. 389, May, 1970, p 77-86. 1 tab 25 ref.

Descriptors: *Legislation, *Environmental, Conservation, Inter-agency cooperation, Administration, Management, Institutional constraints.
Identifiers: *Environmental policy, *Environmental problems.

No one national legislative policy on environmental problems emerged from the Congress at the end of 1969. Congress has reacted to environmental problems in much the same manner in which it has reacted to urban-industrial problems: it has reacted to crises. Legislative assessment of environmental problems from the late 1940's to the present arose out of, but suffers from, that of earlier legislative conservationists. Early 'conservationists' sought primarily the preservation, development, and use of natural resources. Contemporary 'environmentalists', however, are chiefly concerned with the protection and quality of man-made and natural environments for human health and welfare. The legislative environmentalists are working toward the protection of the quality of human life in an urbanized society from all sources of pollution. Some legislation has been passed for programs of research and development; for technical and financial assistance to states and localities, for federal action when other governmental levels fail to act; and for the elimination of some water, air, solid waste, noise and pesticide pollution. Numerous congressional committees and their executive-agency counterparts have become involved in making and administering multiple environmental policies which, at times, overlap or are in conflict. All this has given use to executive and legislative action to coordinate and unify environmental policies, plans, and programs. (Davis-Chicago)
W70-08545

GILL V HEDGECOCK (BOUNDARY DISPUTE AS TO RIPARIAN LANDS ON NON-NAVIGABLE STREAM).

184 SW2d 262-264 (Ark 1944).

Descriptors: *Arkansas, *Boundary disputes, *Non-navigable waters, *Riparian land, Accretion (Legal aspects), Judicial decisions, Legal aspects, Streams, Rivers, Riparian rights, Banks, Watercourses (Legal), Land tenure, Sand pits, Gravels, Boundaries (Property), Excavation, Relative rights, Adjudication procedure, Compensation, Sands, Ownership of beds.

A non-navigable stream operated as a boundary between appellant's and appellee's lands. A sand and gravel developer, who had been removing and selling sand and gravel from the bed of the stream, originated this interpleader action to determine the boundary line between appellant's and appellee's lands and the amount of compensation due each for the sand and gravel taken from their respective lands. Appellants contended that the boundary line should be a line running in the stream equi-distant from high bank to high bank. Appellees contended that they owned the entire bed of the stream. The lower court rejected both contentions and held that the boundary was the middle thread of the stream. The appellate court affirmed holding that both appellant and appellee were riparian owners, notwithstanding the fact that appellant's lands were described in his deed as lying north of the river. The presumption is that the boundary line between riparian lands on a non-navigable stream is the middle thread of the watercourse. (Marsee-Florida)
W70-08549

STATE V AUCOIN (RIPARIAN RIGHTS TO THE BEDS OF NAVIGABLE LAKES).
20 So 2d 136-165 (La 1944).

Descriptors: *Louisiana, *Boundaries (Property), *Boundary disputes, *Ownership of beds, Drainage districts, Judicial decisions, Land tenure, Legal aspects, Legislation, Public rights, Relative rights, Riparian land, Riparian rights, Riparian waters, Prescriptive rights, State governments, Usufructuary right, Watercourses (Legal), High water mark, Navigable waters, Accretion (Legal aspects).

An early government survey had extended the boundary line of several sections across the high

ater mark of a navigable lake. Because of artifi-al drainage, the lake had shrunk to the point here such boundary line was no longer traversing ibmerged lands within the sections. Defendant ırchased lands described in his deed as including l of these several sections. However, prior deeds defendant's chain of title had described the land including only fractional sections, the boundary nning to the edge of the lake. Plaintiff state aimed title as the sovereign to all lands included the original government survey as part of the ke bed. Defendant claimed that, by his deed, he ıd acquired title to the land which had previously een under water since his deed was for complete ctions and not fractional sections as were the eeds of his predecessors in title. In the alternative, claimed: (1) that he had acquired a prescriptive ght to the dried up portion of the lake bed; and 2) that he acquired such land by accretion. The ourt held that prescription did not run against the ate. Furthermore, regardless of descriptions in eeds, beds of navigable lakes belong to the state, nd original boundaries thereof designated by overnment surveys are controlling. Finally, statu-ry rights to accreted land do not apply to land ad-cent to a lake where the lake has diminished in ze. (Clarke-Florida)
/70-08551

ANRAHAN V CORROU (ACTION TO ESTRAIN CITY'S PURCHASE OF WATER OMPANY'S PROPERTY AND FRANCHISE).
70 Misc 922, 12 NYS2d 536-544 (Sup Ct 1938).

escriptors: *New York, *Cities, *Waterworks, Administrative decisions, Water supply, Reser-oirs, Pumping, Pipelines, Sewers, Judicial deci-ons, Legal aspects, Public benefits, Taxes, Water emand, Legilation, Administrative agencies, Utili-es, Water loss, Leakage, Municipal water, Financ-ng, Adjudication procedure, Remedies, Supervisо-y control (Power), Legislation.

Defendant city investigated the advisability of urchasing the property of a water company which upplied the city with water. An appointed commit-ee recommended to the city that its best interest ould be served by the purchase of such property f the water company as was used or useful for ater purposes. Plaintiff taxpayer brought suit to estrain such purchase, alleging that it would be il-egal and a waste of public funds. Plaintiff also al-eged that the purchase would be unreasonable in hat much of the company's property was useless nd obsolete and would require further large ex-enditures for renewals and replacements of exist-ng sewer lines and water mains. The court held hat the purchase was valid in that the legislature, hen it authorized the court to hear a taxpayer's uit to restrain waste by municipal officials, had not iven the court the power to sit in judgment upon uestions of administrative discretion. The statute llowed administrative discretion in dealing with evenue-producing municipal undertakings, includ-ng instrumentalities and properties used or useful n connection with obtaining a water supply. In ight of a presumption that it was made in good aith, and absent a rebutal showing otherwise, the ourt would not pass upon the wisdom of the urchase. (Barnett-Florida)
W70-08554

TENNECO INC V OCAW, LOCAL NO 4-522 INJUCTION TO PROHIBIT PUBLIC USE OF LEVEE).
234 So 2d 246-250 (La Ct App 1970).

Descriptors: *Louisiana, *Levees, *Labor unions, *Public rights, Reasonable use, Streams, Navigable rivers, Mississippi River, Usufructuary right, Public benefits, Labor, Banks, Wages, Judicial decisions, Legal aspects, Riparian rights, Riparian land, Legislation, Relative rights, Navigation, Rivers.
Identifiers: *Servitudes.

Defendant union, in connection with a strike against plaintiff employer, picketed upon plaintiff's land adjacent to the Mississippi River. Plaintiff sought to enjoin the picketing, and the lower court prohibited any picketing that obstructed free ingress and egress to plaintiff's property. However, the injunction excepted from its prohibition that part of plaintiff's property which constituted the levee of the river. Plaintiff appealed the judgment contending that picketing on the levee of a navigable stream in furtherance of a labor dispute was not a public use so as to be allowable by law. Defendant argued that picketing was within the scope of uses which public servitude imposed on riparian owners pursuant to the Louisiana Code. The appellate court held that the character of the servitude imposed by law was not for the public at large, but was only for such use as was incident to commerce or navigation on the river. The picketing on the levee was unlawful and prohibited. (Barnett-Florida)
W70-08556

MINNESOTA WATER RESOURCES BD V COUNTY OF TRAVERSE (ADMINISTRATIVE AGENCY'S STANDING IN JUDICIAL REVIEW OF ITS OWN DECISIONS).

177 NW2d 44-48 (Minn 1970).

Descriptors: *Minnesota, *Watershed management, *Administrative decisions, *Adjudication procedure, Administrative agencies, State governments, Judicial decisions, Water resources, Water law, Boundary disputes, Water resources development, Public rights, Legal aspects, Local governments.

Plaintiff property owners and county commissioners initiated proceedings before defendant state Water Resources Board to establish a county watershed district. Defendant established a watershed district, but upon plaintiffs' appeal the district court modified the watershed boundaries. Defendant then sought appellate review of the district court's judgment. Plaintiffs contended that defendant had no standing to appeal because it was essentially a judicial tribunal rather than an administrative agency and therefore not an aggrieved party. Defendant contended that it was more than an arbiter because it had authority to establish watershed districts, a non-judicial function, and that it also functioned to protect the interests of the public. Finding that the public interest was adequately represented by interested state agencies and conservation groups, the court held that defendant was essentially a quasi-judicial body rather than an administrative agency and therefore had no standing in a judicial review of its own decision. Consequently, the appeal was dismissed. (Liptak-Florida)
W70-08558

GLOBE V LOUISVILLE AND N R R (PRESCRIPTIVE EASEMENT TO FLOOD LANDS).
200 SE 259-268 (Ga 1938).

Descriptors: *Georgia, *Obstruction to flow, *Easements, *Prescriptive rights, Alteration of flow, Downstream, Natural flow, Non-navigable waters, Rainfall-runoff relationships, Legal aspects, Judicial decisions, Condemnation, Legislation, Natural flow doctrine, Riparian land, Riparian rights, Riparian waters, Watercourses (Legal), Bridge construction, Repairing, Impounded waters, Excessive precipation, Dams.
Identifiers: *Trestles (Railroad).

Plaintiff owned land below a trestle built by defendant railroad. The trestle spanned a stream which flowed through plaintiff's property. The trestle collected debris and during heavy rains dammed the stream. This embankment then broke and released the impounded water onto plaintiff's property. Plaintiff asked damages and sought to enjoin the reconstruction of the trestle to its original condition. Defendant contended that, because it had maintained the trestle for twenty-five years, it had acquired a prescriptive right to flood plaintiff's land. The appellate court held that defendant had not acquired such right. The flooding had not been continuous and uninterrupted for the required period. A riparian landowner is entitled to have water reach his land in its natural flow. The obstruction thereof so as to cause it to overflow or injure his land is a trespass. Moreover, to wrongfully turn water onto the land of another is a nuisance. If the proximate cause of the overflow was defendant's failure to properly maintain the trestle, thereby rendering it incapable of accommodating the water during heavy rains, the existence of unusual rainfall did not relieve it of liability. The order dismissing the complaint was reversed. (Price-Florida)
W70-08560

SMITH V WALLACE (TITLE TO ACCRETED LAND).

119 SW2d 813-820 (Mo 1938).

Descriptors: *Missouri, *Missouri River, *Accretion (Legal aspects), *Land tenure, Rivers, Running waters, Surface waters, Channels, Natural flow, Channel flow, Boundaries (Property), Relative rights, Islands, Judicial decisions, Water law, Channel morphology, Legal aspects.

Plaintiff, record title owner of an island in the Missouri River, sought ejectment of defendants from the island. Subsequent to plaintiff's purchase of the island, through a process of erosion and accretion, the island was greatly enlarged on the downstream end so that it extended until it reached an island owned by defendants, while the upstream portion was eroded to the point that none of the island in question was included within the boundaries described in plaintiff's record title. Plaintiff claimed title to the accreted land through adverse possession. Defendants claimed that plaintiff had no interest in the accreted land and thus no interest in the island in question since it was completely beyond the boundaries of his original purchase. The Supreme Court of Missouri ruled that a landowner, be his interest derived from record title or adverse possession, is entitled to ownership of accreted land. However, the court ruled that the questions of adverse possession and actual accretion must be determined by the jury, and since the jury in the trial court had been improperly instructed as to these issues, the judgment for plaintiff was reversed. (Barker-Florida)
W70-08569

SMITH V ARKANSAS IRRIGATION CO (STATE DELEGATION OF POWER OF EMINENT DOMAIN).
142 SW2d 509-511 (Ark 1940).

Descriptors: *Arkansas, *Condemnation, *Eminent domain, *Public benefits, Boundaries (Property), Judicial decisions, Land tenure, Legal aspects, Legislation, Proprietary power, Relative rights, State governments, Water rights, Wells, Dams, Irrigation, Irrigation water, Compensation, Adjudication procedure.
Identifiers: *Public purpose.

An Arkansas statute granted the power of eminent domain to irrigation corporations. Plaintiff irrigation corporation condemned 120 acres of defendant's land. The lands condemned were contigious to a bayou across which plaintiff proposed to construct a dam to impound water for the irrigation of rice fields. The only question on appeal was the right to condemn. The court held that the mandates of due process are satisfied if the purpose for which land is condemned is public and if the owner of the land receives just compensation. Once this is judicially determined, the legislative policy is left supreme. Evidence in this case showed that rice farming was the principal activity in the area and that an abundant supply of water suitable for irrigation was essential. Therefore, the public purpose requirement was thereby fulfilled, and the trial

court's judgment for plaintiff affirmed. (Clarke-Florida)
W70-08574

FISHER V ARKANSAS POWER AND LIGHT CO (NEGLIGENT RELEASE OF IMPOUNDED WATERS BY DAM OWNER).
For primary bibliographic entry see Field 04A.
W70-08575

STONUM V DAVIS (PASSAGE OF TITLE TO SWAMPLAND BY GRANTS AND PATENTS).

152 SW2d 1067-1072 (Mo 1941).

Descriptors: *Missouri, *Patents, *Swamps, *Federal government, State governments, Grants, Judicial decisions, Legal aspects, United States, Land tenure, Overflow, Rivers, Levees, Relative rights, Land use, Real property, Drainage, Land management, Surveys, Taxes.
Identifiers: *Adverse possession.

Plaintiff, record-title holder of the disputed lands, instituted an action to quiet title against defendant, who claimed title to such lands by adverse possession. The lands involved were overflowed swamplands which had passed from the United States to the state of Missouri under a grant taking effect in praesenti in 1850, and thereafter granted by statute from the state to the counties in 1896. Defendant went into possession in 1926 and held the lands in adverse possession against all persons. The United States issued a patent of these lands to the state in 1933 and the state issued its patent of these lands to the counties in 1934. Plaintiff alleged that the time elapsed between defendant's entry into possession and the date of issuance of the government's patents could not be included in determining the period of adverse possession since adverse possession first begins to run when the fee simple title passes out of the government. The court, in affirming the trial court's judgment for defendant, held that when defendant entered into possession the United States and the state had no interest in the lands since they had previously granted away such interest. The patents in 1933 and 1934 were merely deeds of further assurance as muniments of title declaratory of the title passing in the previous grants. (Barnett-Florida)
W70-08576

HARTVEDT V HARPST (LEGAL DESCRIPTION OF ISLANDS ENLARGED BY ACCRETION).

173 SW2d 65-70 (Mo 1943).

Descriptors: *Missouri, *Boundaries (Property), *Accretion (Legal aspects), *Islands, Boundary disputes, Judicial decisions, Land tenure, Legal aspects, Proprietary power, Relative rights, Riparian land, Riparian rights, Riparian waters, Usufructuary right, Watercourses (Legal), Banks, Navigable waters, Avulsion, Low water mark, Rivers.

In an action to quiet title, plaintiff appealed from an order granting defendant's motion to make his petition more definite and certain. The land in question was an island in the Missouri River. Plaintiff's description thereof consisted of a statement of the approximate size in acres and the approximate location by section and township. Plaintiff claimed title to the waters edge of all of said island, which had been considerably enlarged by the process of accretion. Defendant claimed that the description of the island, without reference to metes and bounds, was so vague, uncertain and indefinite as to render identification impossible. The court stated that a riparian proprietor on a navigable stream owns to the water's edge, which may be figured at and to the low water mark. The court then held that the description in plaintiff's petition was clear, definite and certain enough that there was no reasonable basis upon which the trial court could say that defendant was not advised of the precise real estate claimed by plaintiff. (Clarke-Florida)
W70-08578

TAYLOR V COLLINS (NATURAL WATERCOURSE AS A BOUNDARY LINE).
299 Ky 290, 185 SW2d 388-389 (1945).

Descriptors: *Kentucky, *Boundaries (Property), *Meanders, *Boundary disputes, Alteration of flow, Judicial decisions, Legal aspects, Real property, Land tenure, Obstruction to flow, Erosion, Streambeds, Ownership of beds, Streams, Drains, Diversion, Relative rights.

A controversy arose out of a dispute as to the location of the dividing line between two tracts of land. Appellant's deed identified the common boundary between the tracts as a straight line between a rock and a tree while appellee's deed cited the meanders of a stream as the dividing line. Appellant alleged that appellee had altered the flow of the stream, thus causing it to flow over his lands. The lower court found that the true line between the property of the parties ran with the meanders of the stream as it flowed at the time of trial, and enjoined any alteration of the flow of the stream. On appeal, appellant insisted that it was the intention of the parties' common grantor that the description in his deed be the dividing line. The court, in affirming, held that even if appellant's construction of the description in his deed was accepted, it would conflict with the recognized natural object, the creek. Under the applicable law of construction of deeds, the straight line boundary appellant urged had to yeild to the natural object boundary. (Barnett-Florida)
W70-08579

HARRIS V GRAY (RIGHT OF ACCESS TO PUBLIC ROADS).
188 SW2d 933-936 (Tenn Ct App 1945).

Descriptors: *Tennessee, *Easements, *Rivers, *Access routes, Boundaries (Property), Right-of-way, Legal aspects, Judicial decisions, Washouts, Banks, Riparian land, Roads, Streams, Relative rights.

Plaintiff owned a tract of land bounded by an uncrossable stream on one side and defendant's land on the others. Plaintiff had at one time owned the lands occupied by defendant. Plaintiff filed a bill to set up an easement of way from his land over defendant's land to allow access to a public road. The lower court held that plaintiff was entitled to an easement over defendant's land to the public road upon the theory of implied reservation based upon necessity. On appeal the court held that the rule of 'absolute necessity' did not apply in Tennessee. But by reason of all the facts, including evidence of the inability of plaintiff to otherwise cross the stream, the court found an easement arose in plaintiff's favor by reason of the fact that it was reasonably necessary to the full enjoyment of the plaintiff's land. The court held that an implied reservation of an easement for access was presumed to have been within the contemplation of the parties at the time of conveyance. (Barnett-Florida)
W70-08580

KEMP V OWEGO WATER WORKS (WATER RIGHTS IN PERPETUITY CREATED BY WATER WORK'S DESTRUCTION OF SPRING ON GRANTOR'S LAND).
45 NYS2d 794-795 (App Div 1944).

Descriptors: *New York, *Water supply, *Land tenure, *Water works, Reservoirs, Spring waters, Springs, Real property, Judicial decisions, Legal aspects, Relative rights, Water rates, Water rights, Compensation, Damages, Potable water, Water demand
Identifiers: *Injunctions.

Plaintiffs brought action to enjoin defendant water works from shutting off water furnished to their premises. Both plaintiffs' and defendant's land had at one time been held by a common grantor. In conveying land to the water works, the grantor had provided that, if the water works should destroy a spring situated on the grantor's retained land, it should furnish the grantor and her heirs forever, from its water works, an amount of water equal to that supplied by the spring. The spring was destroyed when defendant constructed its reservoir, and for over 40 years defendant supplied water free of charge to successive owners of the land. When defendant notified plaintiffs that they must pay for future water, plaintiffs brought action. Defendant contended that the language of the deed from the grantor created only a condition subsequent and that the right to take advantage of the breach of the condition did not pass beyond the heirs of the grantor. The trial court rejected this contention finding that the deed created a covenant running with the land. Such covenant entitled the lands' owners to free water in perpetuity. The appellate court affirmed per curiam. (Marsee-Florida)
W70-08584

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, SUSQUEHANNA AND CHENANGO RIVERS (TRIPLE CITIES AREA), BROOME COUNTY, NEW YORK.
Corps of Engineers, Baltimore, Md.
For primary bibliographic entry see Field 04A.
W70-08196

FLOOD PLAIN INFORMATION, RIDLEY CREEK, DELAWARE COUNTY, PENNSYLVANIA.
Corps of Engineers, Philadelphia, Pa.
For primary bibliographic entry see Field 04A.
W70-08235

FLOOD PLAIN INFORMATION, CROOKED CREEK AND TRIBUTARIES, HARRISON, ARKANSAS.
Corps of Engineers, Little Rock, Ark.
For primary bibliographic entry see Field 04A.
W70-08238

FLOOD PLAIN INFORMATION, PORTNEUF RIVER AND TRIBUTARIES NEAR POCATELLO, IDAHO AND VICINITY.
Corps of Engineers, Walla Walla, Wash.
For primary bibliographic entry see Field 04A.
W70-08245

FLOOD PLAIN INFORMATION, TRANQUITAS, SANTA GERTRUDIS AND ESCONDIDO CREEKS, KINGSVILLE, TEXAS.
Corps of Engineers, Galveston, Tex.
For primary bibliographic entry see Field 04A.
W70-08246

FLOOD PROFILE STUDY, MORGAN CREEK, LINN COUNTY, IOWA,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02E.
W70-08247

FLOOD PLAIN INFORMATION, FLOYDS FORK, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W70-08260

FLOOD PLAIN INFORMATION, POND CREEK, JEFFERSON COUNTY, KENTUCKY.
Corps of Engineers, Louisville, Ky.
For primary bibliographic entry see Field 04A.
W70-08281

HE NATIONAL FLOOD INSURANCE PRO-RAM--A NEW ELEMENT IN WATER ESOURCE MANAGEMENT,
ederal Insurance Administration, Washington, .C.
heodore H. Levin.
Vater Resources Bulletin, Vol 6, No 1, p 120-125, an-Feb 1970. 6 p.

escriptors: Insurance, *Flood plain zoning, loods, Flood damage, Land use, *Flood plain in-rance, Flood plains, Disasters, Risks, Land evelopment, Flood protection, Legislation, osses, Financing, Cost sharing, Requirements, osts.
dentifiers: Flood plain studies, Flood plain regula-on, Federal assistance, Federal-state cooperation, egulations.

he National Flood Insurance Act of 1968 became ffective on Jan 28, 1969, and provides for sub-dized flood insurance and a cooperative program n which the Federal Government and the private nsurance industry share flood risks. The statute al-ows 5 yr (from Aug 1, 1968) to identify all flood lain areas having special flood hazards and 15 yr o establish flood risk zones in all such areas, and to nake estimates of rates of probable flood-caused oss for the various risk zones. Flood plain areas aving special flood hazards are identified by publi-ation with map reference in the Federal Register. Any structure erected after the date of such publi-ation is not eligible for subsidized insurance. Eligi-ility for the insurance requires an expression of ositive interest and satisfactory assurances of in-erest by a community or county to comply with the and use requirements of the statute. An important urpose of the program is to encourage state and ocal governments to make appropriate land use djustments to constrict land development exposed o flood damage. Initially, the insurance is available nly for 1- to 4-family residential structures and heir contents; studies are underway to extend the rogram to other kinds of properties. (USBR)
W70-08441

FLOOD PLAIN INFORMATION, QUINNIPIAC RIVER, SOUTHINGTON, CONNECTICUT.
Corps of Engineers, Waltham, Mass.
For primary bibliographic entry see Field 04A.
W70-08482

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER AND OLEAN CREEK, OLEAN, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
W70-08505

FLOOD PLAIN INFORMATION OF ALKALI CREEK - VOLUME II, BILLINGS METROPOLITAN REGION, MONTANA.
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 04A.
W70-08506

FLOOD PLAIN INFORMATION, MARTINS CREEK, NORTHAMPTON COUNTY, PENNSYLVANIA.
Corps of Engineers, Philadelphis, Pa.
For primary bibliographic entry see Field 04A.
W70-08511

FLOOD PLAIN INFORMATION, MANITOWOC COUNTY, WISCONSIN.
Corps of Engineers, Chicago, Ill.
For primary bibliographic entry see Field 04A.
W70-08512

6G. Ecologic Impact of Water Development

CLIMATE, SURVIVAL AND THE SECOND-CLASS SOCIETIES IN PALESTINE BEFORE 3000 B. C.,
Balliol Coll., Oxford (England).
Ian Blake.
Advancement of Science, Vol 25, No 126, p 409-421, June 1969.

Descriptors: *Social change, *Water demand, *History, *Precipitation (Atmospheric), *Climatic data, Arid lands, Population, Competition, Migration, Urban sociology, Social impact.
Identifiers: *Palestine, *Archaeology, *Jordan valley.

Modern-day Palestine (Israel-Jordan) is divided into 4 climatic regions: (1) A northern moist area of 400 mm annual rainfall (2) Jordan Valley - a geomorphological depression with no rainfall but many springs and therefore fertile (3) A barren southern arid region of less than 150 mm annual rainfall (4) A marginal region in the transition area between arid and moist areas. The author contends that only very slight climatic changes could cause great changes in the productivity of the marginal region. A Pre-Pottery Neolithic society (PPN) with sophisticated tools and building structures existed throughout the 3 wetter regions from 7000-6000 B.C. and there after completely disappeared. After 5000 B.C. it was succeeded, successively, by 3 Pottery Neolithic Societies (PNi, PNii, and PNiii) of generally lesser technical sophistication. There is some evidence for middle eastern rainfall maxima in 7000, 5000, and 3000 B.C., which correlates with the origins of PPN and PNi and the peak of PNiii. PNi and PNii occupied only the moist, fertile regions, PNiii extended into the marginal region but withdrew after the onset of a new arid period around 2500 B.C. Significantly however it did not collapse, following the withdrawal as did the PPN society. It is speculated that PNiii had developed walled towns, enabling the moister regions to withstand mass migrations from the rainfall-impoverished areas, and that such climatic factors, causing upheavals, may have been significant factors in human social progress. (Casey-Arizona)
W70-08538

07. RESOURCES DATA

7A. Network Design

SOME ISOPLETH MAPS BASED ON LYSIMETER OBSERVATIONS IN THE BRITISH ISLES IN 1965, 1966, AND 1967,
Nature Conservancy, Huntingdon (England).
For primary bibliographic entry see Field 02D.
W70-08176

SPACE VARIATIONS OF PRECIPITATIONS FOR RAINAGE NETWORK DESIGN,
Agricultural Research Service, Danville, Vt. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02B.
W70-08178

THE SYNTHESIS OF SNOWMELT HYDROGRAPHS,
Maine Univ., Orono. Water Resources Research Center.
For primary bibliographic entry see Field 02C.
W70-08244

SYNTHETIC UNITGRAPHS FOR SOUTH AFRICA,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-08500

7B. Data Acquisition

A BURET CYLINDER FOR GRAIN-SIZE ANALYSIS OF SILT AND CLAY (WITH ALGOL-PROGRAM),
Technische Hochschule, Munich (West Germany). Sedimentology and Marine Geology Div.; and Bayerische Landesstelle fur Gewasserkunde, Munich (West Germany).
For primary bibliographic entry see Field 02J.
W70-08169

THE MEASUREMENT OF THE SIZES OF NON-SPHERICAL PARTICLES BY THE HYDROMETER METHOD,
Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 02J.
W70-08201

A METHOD TO STUDY THE DISTRIBUTION OF HEAVY-MINERAL GRAIN ABUNDANCE IN A TURBIDITE,
Mineral Research and Exploration Inst., Ankara (Turkey).
For primary bibliographic entry see Field 02J.
W70-08202

MEASUREMENT OF PARTICLE SHAPE BY FOURIER ANALYSIS,
McMaster Univ., Hamilton (Ontario). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-08205

MEASUREMENT OF THE TOTAL SUCTION OF SOILS BY A THERMISTOR PSYCHROMETER,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 02G.
W70-08220

TURBULENCE MEASUREMENTS IN LIQUIDS USING AN IMPROVED TOTAL PRESSURE PROBE,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
Roger E. A. Arndt, and Arthur T. Ippen.
Text also in French. Journal of Hydraulic Research, Vol 8, No 2, p 131-158, 1970. 28 p, 11 fig, 15 ref, append.

Descriptors: *Turbulence, *Measurement, *Instrumentation, Pressure, Frequency analysis, Vortices, Turbulent flow, Flowmeters, Current meters, Calibrations, Gages.
Identifiers: Turbulence meters.

The performance of an instrument capable of a flat response to total pressure fluctuations in water in the frequency range 0-250 Hz is demonstrated. Measurements of turbulence in open channels and closed conduits were made as well as in boundary layers adjacent to smooth and various rough walls. When compared with hot wire measurements in air by others the performance of the instrument proved very reliable for such turbulence measurements. A design equation is presented in a form suitable for application to commercially available pressure transducers. The natural frequency estimated by this equation agrees reasonably well with the experimentally determined response. Estimates of accuracy are presented and limitations on the use of such an instrument are discussed. (Knapp-USGS)
W70-08226

PROBLEMS OF MEASURING AND EVALUATING SNOWCOVER,
Canada Department of Transport, Toronto (Ontario). Meteorological Branch.
For primary bibliographic entry see Field 02C.
W70-08242

FLUORESCENT SAND AS A TRACER OF FLUVIAL SEDIMENT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-08253

A NEW METHOD FOR MEASURING SHEAR STRESSES IN A HYDRAULICALLY ROUGH FLOW,
Universidad de la Republica, Montevideo (Uruguay).
O. J. Maggiolo, R. Guarga, and J. Borghi.
Text also in French. Journal of Hydraulic Research, Vol 8, No 2, p 189-217, 1970. 29 p, 10 fig, 14 tab, 10 ref.

Descriptors: *Roughness (Hydraulic), *Turbulent flow, *Shear drag, *Measurement, Instrumentation, Shear stress, Boundary processes, Pressure, Flow resistance, Boundaries (Surfaces).
Identifiers: Rough flow (Hydraulic).

In experimental hydrodynamics, methods are needed to determine shear stresses on the walls. Typical examples are all the problems on movable beds, such as critical drag of sediments, side slope stability, and scour in erodible channels. All these cases of practical interest belong to the field of hydraulically rough flow. A new method for measuring shear stress in hydraulically rough flow is evaluated. The method proposed might be applied on circular pipes, rectangular channels and plane plates with boundary layers of any thickness, since the velocity distribution law in hydraulically rough flow is the same in the three cases. It is based on the accomplishment of three measurements by means of an impact tube in the vicinities of the wall. By these three measurements and with no need of a previous determination of the roughness, it is possible to obtain the value of the shear stress on the wall and the value of Nikuradze's roughness equivalent to the given roughness.
W70-08258

THE HYDROGEOLOGIC PARAMETER MU AND A METHOD FOR COMPUTING GROUNDWATER STORAGE,
Akademiya Nauk SSSR. Institut Geologii.
Ya. M. Shilinskaya.
Transl from Dokl Akad nauk BSSR, Vol 13, No 2, p 164-168, 1969. Soviet Hydrology: Selected Papers, Issue No 1, p 89-94, 1969. 6 p, 2 fig, 2 tab, 3 ref.

Descriptors: *Groundwater movement, *Hydrogeology, *Soil water movement, *Water storage, Water level fluctuations, Storage coefficient, Saturated flow, Unsaturated flow, Capillary fringe, Water table.
Identifiers: USSR.

Methods are given for computing groundwater and soil water storage changes with fluctuating water tables. The accuracy was checked in experimental plots by sampling. (Knapp-USGS)
W70-08266

ECOLOGICAL SURVEYS FROM SPACE.
National Aeronautics and Space Administration, Washington, D.C. Office of Technology Utilization

For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402. Price $1.75. National Aeronautics and Space Administration Special Publication SP-230, 1970. 75 p, 46 fig, 3 tab, 7 ref.

Descriptors: *Satellites (Artificial), *Aerial photography, *Surveys, *Remote sensing, Agriculture, Forest management, Geology, Hydrology, Oceanography, Mapping.
Identifiers: *Ecological surveys, Spacecraft, Geography.

Photographs are presented and analyzed for ecologic data in a small sampling and condensation of numerous scientific and technical studies of new images and concepts of the Earth that men have acquired by venturing into space. It is intended mainly to call the attention of more specialists, such as geographers, agricultural engineers, foresters, geologists, hydrologists, oceanographers, and cartographers, to the potentialities of ecological surveys from orbiting satellites. The photographs were taken from aircraft and the Gemini and Apollo vehicles. Additional examples of space photography are available for study in other NASA Special Publications. (Knapp-USGS)
W70-08465

DOSAGE REQUIREMENTS FOR SLUG INJECTIONS OF RHODAMINE BA AND WT DYES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-08498

COMPARISON OF A PROPELLER FLOWMETER WITH A HOT-FILM ANEMOMETER IN MEASURING TURBULENCE IN MOVABLE-BOUNDARY OPEN-CHANNEL FLOWS,
Geological Survey, Fort Collins, Colo.
J. P. Bennett, and R. S. McQuivey.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC, 20402 - Price $3.25. In: Geological Survey Research 1970, Chapter B, US Geological Survey Professional Paper 700-B, p B254-B262, 1970. 9 p, 9 fig, 1 tab, 4 ref.

Descriptors: *Turbulence, *Flowmeters, *Anemometers, Current meters, Water measurement, Flow measurement, Rotating meters, Instrumentation, Calibrations.
Identifiers: Turbulence meters.

The hot-film anemometer may be used in measuring turbulence in large-scale movable-boundary open-channel flows if a correction is made for the drift of the velocity-voltage relation of the sensor. The propeller flowmeter may be used for making turbulence measurements in such flows if corrections are made for the frequency response and spatial averaging of the propeller. For each instrument the true power spectral density of the turbulence velocity may be calculated. Measurements of turbulence intensity and power spectral density were made with both hotfilm anemometer and propeller flowmeter in large-scale openchannel flows. The power spectral densities from the instruments are similar in shape except at the higher frequencies where effects of propeller spatial averaging appear. The efficiency of the propeller flowmeter as a device for measuring turbulence increases as the scale of the turbulence increases. (Knapp-USGS)
W70-08499

7C. Evaluation, Processing and Publication

GRAVITY INVESTIGATION OF THE WATER-BEARING STRATA IN SWAN VALLEY, MONTANA,
Montana Univ., Missoula; and Montana Water Resources Research Center, Bozeman.
For primary bibliographic entry see Field 02F.
W70-08149

AEROMAGNETIC, GRAVITY, AND ELECTRICAL RESISTIVITY EXPLORATION BETWEEN PAHALA AND PUNALUU, HAWAII,
Hawaii Univ., Honolulu. Water Resources Research Center.
William M. Adams, Surendra P. Mathur, and Richie D. Huber.
Available from the Clearinghouse as PB-192 807, $3.00 in paper copy, $0.65 in microfiche. Technical Report No. 28, February 1970. 62p, 11 tab, 28 fig, 15 ref, 2 append. OWRR Project B-008-HI (3).

Descriptors: *Resistivity, *Gravity studies, *Groundwater barriers, Rift zone, Cinder hills, Dikes, Infrared radiation, Borehole geophysics, Hawaii, Geophysics, Exploration.
Identifiers: Pahala (Hawaii), Punaluu (Hawaii), *Aeromagnetic exploration, Rift zone, Cinder hills.

Aeromagnetic, electrical resistivity, and gravity surveys were conducted in the area between Pahala and Punaluu, Hawaii to delineate barriers to groundwater movement. The geophysical data are interpreted and compared to determine the sectors of relatively low gradient groundwater between the barriers. In the Pahala area, two barriers to lateral groundwater movement have been located: the Kolea barrier, which trends roughly east to west, and the second barrier, associated with a 'crack' used as the Pahala dump, designated by this study as the Pahala dump barrier. The Pahala dump barrier definitely appears to terminate at the Kolea barrier. These barriers are defined by magnetic, gravity, and electrical sounding and profiling observations. In the Punaluu area, electrical sounding and profiling observations agree with the conclusions of an earlier infra-red study that a large freshwater outflow, associated with a relatively high head of the water table, occurs. Magnetic and gravity observations agree on the presence of a skewed prismatic body with the top of the body being close to the ground surface. Two test holes have been drilled in the area. The findings verify the geophysical predictions. (Adams-University of Hawaii)
W70-08154

A GENERALIZED COMPUTER MODEL FOR STEADY-STATE PERFORMANCE OF THE ACTIVATED SLUDGE PROCESS,
Robert A. Taft Water Research Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05D.
W70-08165

USING SOIL MAPS TO DELINEATE FLOODPLAINS IN A GLACIATED LOW-RELIEF LANDSCAPE,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W70-08183

DISTRIBUTION OF ESTIMATES OF QUANTILES COMPARED BY DIFFERENT METHODS (AS APPLIED TO STREAMFLOW COMPUTATIONS),
For primary bibliographic entry see Field 02E.
W70-08270

FLOODS ON ROCK RIVER IN NORTHERN ROCK COUNTY, WISCONSIN,
Geological Survey, Washington, D.C.
James O. Shearman.
For sale by US Geol Survey, Washington, DC - Price $0.75. US Geological Survey Hydrologic Investigations Atlas HA-393, 1 sheet, 1970. Text, 7 fig, 1 map, 4 tab, 4 tab, 7 ref.

Descriptors: *Floods, *Wisconsin, Profiles, Maps, Frequency analysis, Stage-discharge relations, Discharge (Water), Flood plains, Lakes, Rivers, Streamflow, Zoning, Flood plain zoning, Nonstructural alternatives.
Identifiers: *Rock River (Wisc).

A one sheet Hydrologic Atlas discusses a 12-mile reach of the Rock River from a point 2.3 miles upstream from U.S. Highway 14 to the outlet of Lake Koshkonong. It describes potential Rock River flooding in Rock County, Wisconsin. The maximum flood for the period of record at each of 5 stream-gaging stations in the Rock River basin is tabulated. Flood frequencies are stated in terms of their recurrence intervals or in terms of their probabilities of occurrence. The regional-flood profile and the flooded area that would exist at the time of the regional-flood discharge are the basic

chnical information upon which flood-plain regu-
tions are to be based. The flood profile is deter-
ined by hydraulic-engineering analyses, and it is
e basis for constructing the flood map. To deter-
ine the regional-flood profile, over 30 flood-plain
oss sections and supplemental data were ob-
ined by field surveys. (Knapp-USGS)
70-08283

**LOODS IN BEDEN BROOK BASIN IN SOMER-
ET AND MERCER COUNTIES, NEW JERSEY,**
eological Survey, Washington, D.C.
nomas G. Ross.
or sale by the US Geol Survey, Washington, DC.
ice $0.75. US Geological Survey Hydrologic In-
stigations Atlas HA-378, 1 sheet, 1970. Text, 7
;, 1 map, 1 tab, 7 ref.

escriptors: *Floods, *New Jersey, Frequency
alysis, Flood plains, Stage-discharge relations,
ofiles, Maps, Discharge (Water), Hydrologic
ta.
entifiers: *Beden Brook (NJ).

one-sheet hydrologic atlas presents hydrologic
ta on the extent, depth, and frequency of flood-
g in the Beden Brook basin in Somerset and
ercer Counties, New Jersey. It was prepared to
ve individuals, organizations, and governmental
encies a technical basis for making decisions on
e use of flood-plain lands. The areal extent of
oding is shown for a hypothetical 50-year flood
ong Beden Brook, Rock Brook, and Pike Run.
ood boundaries shown on Back Brook are those
the March 7, 1967, flood. Backwater from a 50-
ar flood on Pike Run is shown between stations 0
nd 500 in Back Brook. Areal extent of flooding
as delineated on the basis of floodmarks
entified in the field and from profiles developed
om these floodmarks. Depths of inundation and
verflow limits of floods of lesser magnitude than
ose shown on the map can be estimated by using
e relations presented. (Knapp-USGS)
70-08284

IBLIOGRAPHY AND INDEX OF GEOLOGY.
eological Society of America, Boulder, Colo.
or primary bibliographic entry see Field 10.
70-08472

**HREE STATISTICAL PROGRAMS TO
ROCESS LIMNOLOGICAL DATA,**
epartment of Energy, Mines and Resources, Ot-
awa (Ontario). Marine Sciences Branch.
or primary bibliographic entry see Field 02H.
70-08508

08. ENGINEERING WORKS

8A. Structures

**NVESTIGATION AND REPAIR OF EXISTING
EWERS,**
Underwater Tel-Eye Ltd. (Canada).
For primary bibliographic entry see Field 05D.
W70-08296

CHEME FOR THE QATTARA DEPRESSION,
Technische Hochschule, Darmstadt (West Ger-
many).
Friedrich Bassler.
Water Power, Vol 20, No 12, p 494-498,
December 1968. 2 fig, 5 ref.

Descriptors: *Reservoirs, *Pumped storage,
*Hydroelectric power, *Electric power produc-
ion, *Deserts, Arid lands, Environmental effects,
Evaporation, Reservoir evaporation, Reservoir
storage, Tunnels, Underground powerplants, Elec-
tric powerplants, Hydroelectric plants, Electric
power, Transmission (Electrical), Construction
costs.
Identifiers: *Egypt, *Qattara Depression, *Sahara,
*Libyan Desert, *Mediterranean Sea, Area
development.

Scientists from West Germany have been studying the feasibility of constructing a pumped storage power plant on the Qattara Depression of northwestern Egypt. The depression reaches a depth of 135 m below sea level, while the mountain escarpment on its northern edge attains a height of 230 m above sea level. Water would have to be brought in from the Mediterranean Sea, a distance of 80 km, but a tunnel to deliver the water to an underground power station appears feasible. During off-peak hours power could be generated under low pressure using the 60 m drop from the sea-level tunnel to the underground power station. This power could then be used to pump water to a high-level reservoir for storage. If the depression were filled to a level of -60 m and a natural basin at the +215 m level were used for water storage, then a head of 275 m would be available for peak-load power generation. Among the advantages of developing the Qattara Depression are guaranteed energy, proximity to centers of power consumption with attendant savings in transmission costs, and the potential for future area development. Economic feasibility of the 4000MW project will be determined by the cost of tunnel construction. (Carr-Arizona)
W70-08523

**HYDRO POTENTIAL OF THE TEXAS WATER
PLAN,**
Texas Tech. Univ., Lubbock.
George A. Whetstone.
Water Power, Vol 22, No 2, p 52-53, February 1970. 1 fig, 16 ref.

Descriptors: *Texas, *Inter-basin transfers, *Pumped storage, *Hydroelectric power, *Mississippi River, Water transfer, Diversion, Water utilization, Irrigation, New Mexico, Arid lands, Semiarid climates, Electric power production, Dams, Reservoirs, Hydroelectric plants, Economic feasibility.
Identifiers: *Texas water plan.

The basic proposals contained in the Texas Water Plan are outlined and potential water power development under the project is discussed. The majority of the energy supply in Texas has never been derived from water power and conventional hydroelectric developments are unlikely to occur in the future. Pumped storage, however, may be feasible in areas of favorable topography and adequate water supply. A number of sites should be available in East Texas in connection with storage reservoirs envisioned as part of the Texas Water Plan. Other sites should exist at the pumping stations of the Trans-Texas canal. In light of this, it is quite likely that a number of pumped storage projects will be included in the plan. (Carr-Arizona)
W70-08524

**FISHER V ARKANSAS POWER AND LIGHT
CO (NEGLIGENT RELEASE OF IMPOUNDED
WATERS BY DAM OWNER).**
For primary bibliographic entry see Field 04A.
W70-08575

8B. Hydraulics

**A NOTE ON THE RECOGNITION, CAUSE, AND
POSSIBLE GEOLOGIC IMPORTANCE OF
GROUNDWATER MICROFLOW SYSTEMS IN
ALLUVIAL-CHANNEL BED-FORMS,**
Wisconsin State Univ., Oshkosh. Dept. of Geology; and North Dakota Univ., Grand Forks. Dept. of Geology.
For primary bibliographic entry see Field 02E.
W70-08207

**DERIVATION OF FORMULAE FOR VARIABLE
LAG TIME,**
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-08212

**OPEN CHANNEL APPLICATIONS FOR
DILUTE POLYMER SOLUTIONS,**
Queen's University of Belfast (Northern Ireland). Dept. of Civil Engineering.
R. H. J. Sellin, and B. J. S. Barnard.
Text also in French. Journal of Hydraulic Research, Vol 8, No 2, p 219-228, 1970. 10 p, 5 fig, 12 ref.

Descriptors: *Open channel flow, *Turbulent flow, *Fluid friction, Sewers, Shear drag, Water chemistry, Water properties, Water structure.
Identifiers: Hydrodynamic drag reduction, Polymers.

The effect of long chain polymer additives on turbulent flow lessens hydrodynamic drag. In seeking practical applications of this effect work has been concentrated on ship drag reduction and on flow in pipes. Recent work has explored a possible hydrodynamic connection with the known visco-elastic properties of the polymer solutions but experimental verification is not easy to obtain because of the low concentrations of polymer solutions (as little as 1 ppm) known to exhibit drag-reducing effects. Experiments were conducted with a polyethylene oxide which is an unbranced chain molecule. Maximum flow augmentation was achieved for sewers using a dose of about 8 ppm whereas for the pipe flow, augmentation was still increasing at 20 ppm. It is suggested that Polyox or some other drag-reducing agent could with advantage be added to the storm sewer system of a town when there is danger of the system becoming surcharged. (Knapp-USGS)
W70-08257

**A NEW METHOD FOR MEASURING SHEAR
STRESSES IN A HYDRAULICALLY ROUGH
FLOW,**
Universidad de la Republica, Montevideo (Uruguay).
For primary bibliographic entry see Field 07B.
W70-08258

MOBILE BED HYDRAULICS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02J.
W70-08259

**THERMAL GRADIENTS IN RIVERS AND
RESERVOIRS DUE TO HEATED PLANT EF-
FLUENTS,**
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W70-08423

**SEPARATION CONTROL DEVICES IN
DIVERGING CHANNELS,**
Indian Inst. of Science, Bangalore.
B. Vasudeva Rao, and K. Seetharamaiah.
13th Congress International Association of Hydraulic Research Proceedings, Vol 1, p 113-122, Aug-Sept 1969. 10 p, 7 fig, 1 tab, 6 ref.

Descriptors: *Flow separation, *Hydraulic conduits, Hydraulic design, Hydraulic engineering, Hydraulic models, Model tests, *Transition flow, Vanes, Flow control, *Diffusers, Channel flow, Channels, Open channel flow, Hydraulics, Fluid mechanics.
Identifiers: Divergence, *Diverging sections, Velocity head, India, Splitters, Blockage effect (Hydraulic), Foreign testing.

Flow through diverging channels presents design problems because of separation phenomena in the diverging flow, resulting in low pressure recovery or velocity head recovery in the downstream section. Flow separation adversely affects the exit flow conditions and performance level of the diverging channel. Maximum effectiveness in simple diffusers is achieved with an angle of 7 deg between the diverging walls of the diffuser, but the resulting structure is very long and not economical. One method for eliminating flow separation is using vanes to change diffuser geometry so that regions of stalled flow will not form, blocking the flow. Hydraulic model tests on wide diverging channels with vanes were conducted to control flow separation and to determine the efficiency of the expansion with respect to velocity head recovery. Results indicate that increasing the uniformity coefficient of the flow downstream increases velocity head recovery and the efficiency of the expansion. An expression to evaluate pressure head recovery is derived from momentum considerations and shows good agreement with experimental values. (USBR)
W70-08452

FLOW INVESTIGATIONS IN A WATER FLOW CHANNEL AT SUBSONIC AND SUPERSONIC VELOCITIES,
A. Bolcs.
Escher Wyss News, Vol 42, No 1, p 18-29, 1969. 12 p, 20 fig, 1 tab, 9 ref.

Descriptors: *Open channel flow, Fluid flow, *Subsonic flow, Boundary layers, *Supersonic flow, Hydraulics, Thre-dimensional, Laminar flow, Two-dimensional, Open channels, Flow around objects, Hydraulic turbines, Hydraulic models, Mach number, Shock waves, Turbine blades, *Velocity, Fluid friction, Dyes.
Identifiers: *Flow patterns.

Photographic recordings of flow patterns in an open flow channel are discussed. The flow at the surface of the water is made visible by streamers of dye. The photographs of the flow around an obstacle show the boundary-layer flow caused at the channel bottom. The recordings show that the 2 flows are basically different. As a result of frictional action, a 3-dimensional flow is formed around the model in the vicinity of the channel walls; for small values of the ratio of water depth to model length, this flow pattern develops over the entire height of the layer of water. In addition to the photographs at subsonic velocities, flow patterns are shown for shallow-water flow that is analogous to supersonic flow. (USBR)
W70-08458

COMPARISON OF A PROPELLER FLOWMETER WITH A HOT-FILM ANEMOMETER IN MEASURING TURBULENCE IN MOVABLE-BOUNDARY OPEN-CHANNEL FLOWS,
Geological Survey, Fort Collins, Colo.
For primary bibliographic entry see Field 07B.
W70-08499

8C. Hydraulic Machinery

HIGH-VOLTAGE ELECTRICAL TESTING OF POWER EQUIPMENT,
GEC Power Engineering Ltd., Trafford Park (England).
A. S. Husbands.
Science and Technology, Vol 36, No 1, p 42-48, 1969. 7 p, 6 fig, 1 tab, 9 ref.

Descriptors: *Extra high voltage, *Test facilities, Laboratory tests, Laboratory equipment, *Electrical equipment, *Testing, Switchgear, Power transformers, Electrical insulators, Impulse tests (Electrical), Contamination, Standards.
Identifiers: *Foreign testing, Great Britain, High voltage, Flashover, Switching surges.

Test facilities at a British high-voltage laboratory are described. Particular reference is made to the test and development work required for testing new high-voltage equipment. The arrangement and purposes of all test devices are explained, and examples of high-voltage investigations are given. All standardized tests can be performed to demonstrate the qualities of insulation and soundness of design. In addition, special tests simulating adverse service conditions, including surge voltages and the effects of rainfall or contamination on the surfaces of insulators, can be made. The laboratory can test adequately all high-voltage components of systems rated up to 750 kv rms, and in certain cases for higher system voltages. (USBR)
W70-08447

LARGE KAPLAN TURBINES,
E. Muhlemann.
Escher Wyss News, Vol 42, No 1, p 3-10, 1969. 8 p, 11 fig, 7 ref.

Descriptors: *Kaplan turbines, Hydraulic turbines, Efficiencies, Hydraulic machinery, Turbine runners, Costs, Acceptance testing, Model tests, Performance tests, Foreign research, Cavitation, Stress, Design, Thrust bearings, Servomechanisms.
Identifiers: Switzerland, Turbine efficiency, Turbine head covers.

Two of the largest Kaplan turbine units in operation are described. The turbines were manufactured by Escher Syss, Switzerland, and are installed at Aschach plant of the Danube Electricity Co, Vienna, and the Jupia plant Sao Paulo Central Electricity Board, Brazil. Advantages of large hydraulic turbines of 8-m runner diameter are reduction in relative cost, such as cost per unit weight, and gain in hydraulic efficiency because of reduction in flow losses. Above 8-m runner diameter, these advantages drop rapidly. Performance testing of model turbines as an alternative to acceptance testing of full-scale units is discussed. Design factors for the large Kaplan units are considered. (USBR)
W70-08456

THE 'BIPLANE' BUTTERFLY VALVE, SYSTEM ESCHER WYSS,
Bruno Barp, and Herbert Grein.
Escher Wyss News, Vol 42, No 1, p 11-17, 1969. 7 p, 14 fig, 1 tab, 8 ref.

Descriptors: *Butterfly valves, *Head loss, Weight, Fluid flow, Flow separation, Velocity, Fluid mechanics, Mechanical engineering, Model tests, Foreign research, Efficiencies, Cavitation, Test procedures, Pressure, Losses, *Hydraulic valves, *Hydraulic gates and valves.
Identifiers: Switzerland, *Test results.

A butterfly valve designed for low pressure loss and optimum use of material is described. Design of a butterfly valve is based on hydraulic strength and lowest weight as well as minimum losses through the valve. Comparative weights and head losses of various full-scale butterfly valves are tabulated. Through extensive model testing, the new biplane disc-shaped butterfly valve with flow guides was developed. The tests demonstrate the superiority of the valve, particularly where large diameters are concerned. (USBR)
W70-08457

ON PROCEDURES FOR RELIABILITY EVALUATIONS OF TRANSMISSION SYSTEMS,
Power Technologies, Inc., Schenectady, N.Y.; and General Electric Co., Schenectady, N.Y.
Robert J. Ringlee, and Sheila D. Goode.
Institute of Electrical and Electronics Engineers, Transactions on Power Apparatus and Systems, Vol PAS-89, No 4, p 527-536, Apr 1970. 10 p, 8 fig, 4 tab, 19 ref, 2 append, disc.

Descriptors: Transmission (Electrical), *Reliability, Performance, Bus (Electrical), Evaluation, *Transmission lines, Forecasting, Power systems operations, Computers, Overloads, Bibliographies, Analysis, Probability, *Failure (Power), Substations (Electrical), Circuit breakers, Analytical techniques, Power tranformers, Calculations, Models.
Identifiers: *Outages.

Quantitative reliability evaluations of transmission systems are discussed. Substantial progress has been made in perfecting methods for simulating network power flows rapidly on digital computing machines, and the time for the general realization of quantitative transmission system reliability evaluations may be near. One limiting area appears to be practical, rapid evaluation of stability limits. Techniques for predicting the frequency with which certain transmission contingencies will occur have been known for some time. Combining rapid simulation methods with event prediction techniques may offer a practical method for accomplishing transmission system reliability evaluations. A generalization of the concepts of the component run-fail-repair life cycle and a description of a step-by-step procedure for performing reliability evaluations are included. Simple algebraic results for the prediction of frequency and duration of transmission contingencies are obtained using the renewal process theory. Techniques described are as feasible for hand as for machine computations. (USBR)
W70-08459

EVALUATION OF INSULATION AND DAMAGE OF HIGH-VOLTAGE STATOR WINDINGS,
Hitachi Ltd., Tokyo (Japan).
K. Matsunobu, and T. Inoue.
Electronic Engineering (Japan), Vol 89, No 8, p 1-8, Aug 1969. 8 p, 13 fig, 4 tab, 9 ref, append.

Descriptors: *Electric insulation, *Dielectrics, Testing, Performance, *Stators, *Electrical coronas, Electric generators, Cracks, Quantitative analysis, Electric motors, Voids, Laboratory tests, Experimental data, Foreign research.
Identifiers: Breakdown, Service life, *Electric discharges, *Electric machinery, Japan.

Breakdown of insulating materials used in high-voltage stator windings is caused by corona or treeing discharges originating from defects such as voids, cracks, or surface scratches. The dielectric strength of electric machinery is usually tested by one of several methods, but no previous study has been made on the relations between these various methods or on the relation between insulation life and breakdown voltage. Special attention is placed on local insulation damage produced inside high-voltage stator windings, and a relations between damage rate and insulation life is formulated. A quantitative analysis is presented on the effect that various test methods have on breakdown voltage, insulation life, and damage rate. Calculated results agree well with measurements. The cumulative rule seems to hold true for insulation life and is being used to predict failure rates of electronic devices. (USBR)
W70-08460

8D. Soil Mechanics

THE USE OF GRAVITY SHAFTS FOR GROUNDWATER RECHARGE - PHASE I,
North Dakota Water Resources Research Inst., Fargo.
For primary bibliographic entry see Field 04B.
W70-08152

DISTORTION TESTS ON DRAINED NATURAL CLAY SAMPLES,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02G.
W70-08481

8E. Rock Mechanics and Geology

GEOPHYSICAL EXPLORATION AT SMALL EARTHFILL DAMSITES,
Department of Agriculture, Fresno, Calif.
E. E. Haskell, and Dorn Dunham.
Journal of Soil and Water Conservation, Vol 25, No 2, March-April 1970, p 66-67, 5 fig, 2 ref.

Descriptors: *Terrain analysis, Trenches, Spillways, Groundwater movement, *Rock foundations, Earth dams, *Rock properties.
Identifiers: *Seismic refraction method, Backhoe digging, Auger holes, Sierra Nevada foothills, California.

When constructing core trenches and spillways at small dams it is necessary to determine the types of rocks present at various levels and the solidity of these rocks. Although hand augering and backhoe digging are adequate methods for high depth calculations, the seismic refraction method is more reliable for deeper level excavation. (Holmes-Rutgers)
W70-08429

STATUS AND TRENDS IN LOGGING,
Marathon Oil Co., Littleton, Colo.
Hilton B. Evans.
Geophysics, Vol 35, No 1, p 93-112, Feb 1970. 20 p, 16 fig, 65 ref.

Descriptors: *Borehole geophysics, Boreholes, Drill holes, *Subsurface investigations, *Logging (Recording), Wells, Exploration, Geophysics, Reviews, Bibliographies, *Rock properties, Geologic formations, Data processing, Geologic investigations, Computers.
Identifiers: *Well logging, *Geophysical logging, Analog-to-digital converter, Geophysical prospecting.

Logging service companies are attempting to provide a good selection of borehole logging devices popular with the oil industry. The introduction of new services or new devices is being limited because oil companies are standardizing the logging suites run in the various geographic operating areas. Some new techniques appear to have important uses. Standard logging suites and evaluation techniques are discussed in terms of open-hole and cased-hole devices, and measurement of rock properties. Methods include nuclear, electrical, acoustic, gravity, and magnetic logging. The use of logging methods is increasing outside the petroleum industry in exploration and evaluation of mineral deposits, groundwater, and other geological investigations. Log digitizing and computer processing are routine in major oil companies, but methods and equipment vary greatly. Commercial digitizing services are currently too expensive for extensive use, but per-log costs are declining as more companies offer competitive services. Current research and development emphasis is on pulsed neutron-spectroscopy, acoustic measurements, and digital processing techniques. Has 65 references. (USBR)
W70-08446

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

WATER RESEARCH SUMMARY.
Oregon State Univ., Corvallis. Water Resources Research Inst.

Oregon State University Water Resources Research Institute Report No 3, March 1970. 164 p.
Descriptors: *Water resources, *Water Resources Research Act, *Research facilities, *Projects, *Oregon, Resource development, Laboratories, Grants, Universities.
Identifiers: *Water resources research.

Research facilities and current projects at Oregon State University in water-related subjects are listed. Water related research sponsored by the Water Resources Research Institute at other universities in Oregon is included. The subject areas are water supply augmentation, water quality, and recreational use of water. (Knapp-USGS)
W70-08473

10. SCIENTIFIC AND TECHNICAL INFORMATION

ESTUARINE RADIOECOLOGY - A BIBLIOGRAPHY OF REPORT LITERATURE,
Department of the Interior, Washington, D.C. Office of Library Services.
John M. Lattimer.
US Department of Interior, Office of Library Services Bibliography Series No 16, March 1970. 52 p, 219 ref.

Descriptors: *Bibliographies, *Estuaries, *Estuarine environment, *Radioecology, Radioactivity effects, Radioactive wastes, Radioisotopes.
Identifiers: *Estuarine radioecology.

This bibliography on estuarine radioecology lists technical reports published from 1960 through June 1969, with a few published after that date. These reports are concerned with the biological accumulation and cycling of radionuclides, radioactive sedimentation, and the effects of radiation on the biota associated with estuaries. A special feature of this bibliography is the listing of research projects in progress as of June 1969. An index of authors and a separate index of subjects is also provided. (Knapp-USGS)
W70-08470

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Georgia Environmental Research Center	W70-08420--08421	2
Mississippi Water Resources Research Institute	W70-08423	1
C. Others		
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1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 3, NUMBER 21
NOVEMBER 1, 1970

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 21
NOVEMBER 1, 1970

W70-08585 -- W70-09010

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

VESTIGATION OF ANOMALOUS WATER,
well Technological Inst. Research Foundation, ass.
la M. Fabuss, Alexander Dolman, Robert slavich, and Demetrios Kekis.
r sale by Superintendent of Documents, US vernment Printing Office, Wash, DC 20402 - ce $0.45. US Office of Saline Water Research l Development Progress Report No 558, 1970. p, 10 fig, 2 tab, 20 ref. Contract No 14-01-0001-96 OSW.

scriptors: *Water structure, *Water properties, drogen bonding, Thermodynamic behavior, scosity, Melting, Freezing, Boiling, Laboratory ts.
ntifiers: *Anomalous water, Polywater.

e preparation and certain properties of anoma- s water were investigated. Anomalous water was med in quartz and Pyrex capillaries, particulate ds, and on flat plates. Samples as large as 3 mg re made in a single operation. A quantitative ex- ession was given to express the anomality of a en sample on the basis of its expansion charac- tistics. The formation of anomalous water and its ative stability were explained on the basis of gular solution thermodynamics. Highly hydroxy- ed surfaces are required for its attachment and mation. Most anomalities can be explained by excess of nonhydrogen-bonded close-packed ucture in the water. The entirely anomalous ter represents this structure without the esence of an ice-like hydrogen-bonded structure. is explains phenomena such as the expansion aracteristics and phase behavior, and gives infor- ation in regard to formation and preparation. (K- pp-USGS)
70-08977

HE EFFECT OF SOME SUBSTANCES ON THE OEFFICIENT OF CONDENSATION OF ATER DROPS,
M. Shinyayev,
r sale by Clearinghouse, Springfield, Va. - Price .00. Transl from 'Problemy Fiziki Atmosfery. ornik 5.' Leningrad State Univ Press, 1967. In: oblems of Atmospheric Physics, Collection 5, ational Aeronautics and Space Administration chnical Translation Report NASA TT F-587, p 6-260, June 1970. 5 p, 1 fig, 1 tab, 11 ref.

escriptors: *Condensation, *Evaporation, Evaporation control, *Surfactants, Soaps, Surface nsion, Water chemistry, Water properties, olutes, Aqueous solutions.
entifiers: Surfactant effects.

he coefficient of condensation of water drops is amined in relation to three substances; sodium urate, sodium palminate and isoamyl alcohol. It is sumed that the nature of the effect of molecules soluble surface-active solutions on the evapora- on differs basically from the characteristics of sur- ce films of nonsoluble surface active substances. Knapp-USGS)
70-09009

1B. Aqueous Solutions and Suspensions

IVESTIGATION OF ANOMALOUS WATER,
owell Technological Inst. Research Foundation, ass.
or primary bibliographic entry see Field 01A.
'70-08977

HE EFFECT OF SOME SUBSTANCES ON THE OEFFICIENT OF CONDENSATION OF 'ATER DROPS,
or primary bibliographic entry see Field 01A.

W70-09009

02. WATER CYCLE

2A. General

WATER BALANCE IN NORTH AMERICA,
Arleigh H. Laycock, Martha Francisco, and Thelma Fisher.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, 2969. 335 p.

Descriptors: *Conferences, *Water balance, *Regions, *United States, Hydrologic budget, Hydrologic cycle, Rainfall-runoff relationships, Surface-groundwater relationships.
Identifiers: *Canada, *North America.

The water balance of North America was discussed in a symposium of 8 sections comprising 34 papers. The topics of the sections are: regional water balance patterns; local patterns; streamflow and groundwater; water balance modifications (regime and quality, yield increase, utility increase, and legal responsibility); research programs, and research needs. (Knapp-USGS)
W70-08597

THE AVERAGE ANNUAL WATER BALANCE OF THE WORLD,
Delaware Univ., Newark. Dept. of Geography, and Thornthwaite (C. W.) Associates, Elmer, N. J.
John R. Mather.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 29-40, 1969. 12 p, 2 fig, 7 tab, 15 ref.

Descriptors: *Water balance, *Hydrologic cycle, Runoff, Streamflow, Rainfall-runoff relationships, Climatology, Weather, Climates, Precipitation (Atmospheric), Mapping.
Identifiers: World water balance.

World maps of annual precipitation prepared by Geiger were analyzed to provide average annual values by 10 degree squares of latitude and longitude as well as by continent and ocean areas. The depth of runoff is greatest from South America, followed by Asia, Europe and North America in that order. Runoff from the North American continent is below the average from all continental land masses. New figures for global precipitation and evapotranspiration are utilized to evaluate the average annual hydrologic cycle. The results emphasize the small influence of local evapotranspiration in local precipitation. Quantitative estimates are mode of the mobility of moisture from oceans to land and back again in the atmosphere. (Knapp-USGS)
W70-08598

AN AVERAGE WATER BALANCE FOR CANADA,
Windsor Univ. (Ontario).
Marie E. Sanderson.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 41-54, 1969. 14 p, 9 fig, 8 ref.

Descriptors: *Water balance, *Regions, Climatology, Weather, Precipitation (Atmospheric), Runoff, Rainfall, Evapotranspiration, Gaging stations, Maps, Mapping, Streamflow, Hydrologic cycle, Hydrologic budget.
Identifiers: *Canada.

If long term average conditions are assumed, an annual water balance equation can be written for Canada. The average parameters in Canada's water balance are presented on maps. Such maps are tentative, based, except along Canada's southern border, on inadequate data. The precipitation map is based on average precipitation figures from some 2,000 Department of Transport climatic stations. Amounts of potential and actual evapotranspiration and water deficiency are obtained by the Thornthwaite water balance method assuming an average water holding capacity of the soil. The runoff maps are based on stream gaging data complemented by climatically determined figures of water surplus. Some estimates of volumes of runoff are obtained by planimetry. (Knapp-USGS)
W70-08599

WATER BALANCE PATTERNS IN THE CONTINENTAL UNITED STATES,
Geological Survey, Menlo Park, Calif.
John R. Crippen.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 55-61, 1969. 7 p, 2 fig, 1 tab, 5 ref.

Descriptors: *Water balance, *Water utilization, *United States, Rainfall-runoff relationships, Irrigation water, Municipal water, Industrial water, Discharge (Water), Streamflow, Runoff, Evapotranspiration.
Identifiers: U.S. water balance.

The conterminous United States receives as annual precipitation about 1,430 cubic miles of water. Of this, about 392 cubic miles leaves the national boundaries by entering the sea or by river outflow to other nations. Average precipitation ranges from 3 or 4 inches annually in desert valleys of the southwest to well over 120 inches in coastal mountains of the northwest. The one-third of the nation east of the Mississippi River receives everywhere more than 30 inches of precipitation annually. Average annual runoff to the Pacific Ocean is about 92 cubic miles, to the Gulf of Mexico about 191 cubic miles, and to the Atlantic Ocean or its tributaries about 109 cubic miles. Deficiencies occur most frequently in the agricultural regions of the southwest, where the annual precipitation is highly variable and irrigation practices require large quantities of water for use over large areas. Deficiencies in the eastern part of the country usually affect smaller regions where there is concentrated industrial or domestic use; therefore the greatest impact of shortages is upon the major metropolitan centers, particularly those in the densely settle coastal region from Boston, Mass., to Washington, D.C. (Knapp-USGS)
W70-08600

INSTRUMENTATION AND OBSERVATION TECHNIQUES.
For primary bibliographic entry see Field 07B.
W70-08611

REVIEW HYDROMETEOROLOGICAL INSTRUMENTATION,
Department of Transport, Toronto (Ontario). Meteorological Branch.
For primary bibliographic entry see Field 07B.
W70-08612

RADAR AS A REMOTE SENSOR FOR HYDROLOGY,
McGill Univ., Montreal (Quebec). Dept. of Physics.
For primary bibliographic entry see Field 02B.
W70-08625

STATUS OF PILOT WATERSHED STUDIES IN ARIZONA,
Forest Service (USDA), Flagstaff, Ariz.
For primary bibliographic entry see Field 03B.
W70-08946

STORAGE AND HYDROLOGIC PROCESSES,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
Don M. Gray, and D. I. Norum.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 151-162, 1969. 4 fig, 16 ref.

Descriptors: *Water storage, *Surface-groundwater relationships, *Rainfall-runoff relationships, Time lag, Routing, Soil moisture, Soil water, Groundwater, Surface waters, Groundwater movement, Water balance, Hydrogeology, Infiltration, Evapotranspiration.
Identifiers: *Basin yield.

The influence of the storage component on individual hydrologic processes in the water balance equation is discussed. Soil moisture content affects: (a) the time-variation, the depth and volume of infiltration and (b) the time-rate, distribution and amount of evapotranspiration by a given crop. Details are presented of the techniques and methodology to quantitatively evaluate the effect of soil moisture storage on these processes. Storage is also important to surface and groundwater flow systems. Particular emphasis is placed on the modulating and attenuating effect of storage on both peak flows and basin yield. Flow may be considered as a simple input-output system. Examples are given to demonstrate the effect of lag-time in simple mass balance or water balance equations. Additional discussions are directed to field methods of evaluating storage in these systems. (See also W70-08597)
W70-08987

RECOVERY OF POLLUTED WATER,
Ontario Water Resources Commission, Toronto. Great Lakes Water Quality Surveys Program.
For primary bibliographic entry see Field 05G.
W70-08988

PHYSIOGRAPHY-LAND USE INTERACTIONS IN WATERSHED MANAGEMENT,
British Columbia Univ., Vancouver. Dept. of Forestry.
For primary bibliographic entry see Field 05B.
W70-08989

URBANIZATION AND THE WATER BALANCE,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 04C.
W70-08990

VEGETATION MANAGEMENT FOR WATER YIELD,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W70-08991

CLOUD SEEDING AND RAIN MAKING,
Alberta Univ., Edmonton. Dept. of Meteorology.
For primary bibliographic entry see Field 03B.
W70-08992

SOME RECENT RESEARCH IN EVAPORATION SUPPRESSION,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 03B.
W70-08993

PRIME-ALBERTA'S BLUEPRINT FOR WATER DEVELOPMENT,
Department of Agriculture, Edmonton (Alberta). Water Resources Div.
For primary bibliographic entry see Field 06B.
W70-08994

POTENTIAL EFFECTS OF SPRINKLED AGRICULTURE ON THE NORTH AMERICAN WATER BALANCE,
California Univ., Davis. Dept. of Agricultural Economics.
David William Seckler.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 235-242, 1969. 1 tab.

Descriptors: *Water resources development, *Water conservation, *Water balance, *Sprinkler irrigation, Sprinkling, Water demand, Water utilization, Irrigation practices, Water consumption, Consumptive use, Water management (Applied).
Identifiers: North America.

Sprinkler irrigation constitutes 15 percent of the irrigated acreage of the western United States and is growing at an annual rate of 13 percent. This trend is likely to continue in the foreseeable future because of the profitability of sprinkler irrigation to agricultural firms. Because of the substantial savings in water under sprinkler irrigation, water coefficients used for planning future agricultural development in the western United States must be substantially reduced. The possibility of converting presently furrow-irrigated land to sprinkler systems, together with modern techniques of efficient furrow irrigation, may create sufficient water conservation to eliminate the need for large-scale water development in the foreseeable future. (See also W70-08597)
W70-08995

MODIFYING THE WATER BALANCE BY DESALINATION,
Geological Survey, Washington, D.C.; and Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03A.
W70-08996

IS WATER DIFFERENT,
Department of Energy, Mines and Resources, Ottawa (Ontario). Policy and Planning Branch.
For primary bibliographic entry see Field 06C.
W70-08997

PRELIMINARY EVALUATION OF THE WATER BALANCE IN THE CENTRAL AMERICAN ISTHMUS,
Leif Ahlgren, Eduardo Basso, and Roberto Jovel.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 288-298, 1969. 5 fig, 19 ref.

Descriptors: *Water balance, *Regions, Hydrologic budget, Hydrologic cycle, Rainfall-runoff relationships, Evapotranspiration, Precipitation (Atmospheric), Streamflow, Groundwater movement, Runoff.
Identifiers: Central America.

Existing hydrologic and meteorologic data, although limited in quantity and quality, have enabled the preparation of a first preliminary quantitative evaluation of the hydrologic cycle for the Central American Isthmus. A detailed isohyetal map, covering the 1938-1967 hydrologic time period was prepared for the study area. Annual rainfall rates were found to range between more than 5000 millimeters in certain localized areas of central Costa Rica and Guatemala, and less than 1000 millimeters in Honduras and Guatemala. Pronounced dry periods occur, which has a direct influence on the distribution of runoff and on the amount of water consumed by permanent vegetation and crops. About 45 percent of the total rainfall runs off on the surface to the oceans, 48 percent is consumed by transpiration and evaporation, 7 percent flows out to the oceans through subsurface media. (See also W70-08597)
W70-09000

WATER INVENTORY STUDIES IN THE UNITED STATES AND THE I.H.D. PROGRAM,
National Committee for the International Hydrological Decade, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-09001

CANADIAN RESEARCH,
National Committee for the International Hydrological Decade, Ottawa (Ontario).
For primary bibliographic entry see Field 02E.
W70-09002

UNITED STATES WATER RESOURCES RESEARCH NEEDS,
Illinois Univ., Urbana. Coll. of Agriculture.
For primary bibliographic entry see Field 09C.
W70-09003

2B. Precipitation

THE AVERAGE ANNUAL WATER BALANCE OF THE WORLD,
Delaware Univ., Newark. Dept. of Geography, and Thornthwaite (C. W.) Associates, Elmer, N. J.
For primary bibliographic entry see Field 02A.
W70-08598

AN AVERAGE WATER BALANCE FOR CANADA,
Windsor Univ. (Ontario).
For primary bibliographic entry see Field 02A.
W70-08599

SOME CURRENT STUDIES OF LOCAL PRECIPITATION VARIABILITY OVER WESTERN CANADA,
Department of Transport, Toronto (Ontario). Meterorological Branch.
H. L. Ferguson, and D. Storr.
Preceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 80-100, 1969. 21 p, 15 fig, 1 tab, 23 ref.

Descriptors: *Distribution patterns, *Precipitation (Atmospheric), *Regions, Rain gages, Networks, Gaging stations, Water balance, Hydrologic budget, Runoff, Rainfall-runoff relationships.
Identifiers: *Canada.

The accuracy of areal estimates of precipitation for use in water balance calculations is discussed. Estimates from point measurements are subject to large errors due to problems of instrument design and siting. Areal variability is related to the form of precipitation, topographical factors, and whether the precipitation is of a showery or steady type. Some results of current Canadian studies are presented to illustrate these points. The error of estimate of areal precipitation over a given region is a function of network density and the accumulation period. This relationship is examined for two large areas, Southern Saskatchewan and the Lower Great Lakes-Upper St. Lawrence area. A map is presented showing the standard precipitation network density across Canada. (Knapp-USGS)
W70-08602

REVIEW HYDROMETEOROLOGICAL INSTRUMENTATION,
Department of Transport, Toronto (Ontario). Meteorological Branch.
For primary bibliographic entry see Field 07B.
W70-08612

AUTOMATIC CLIMATOLOGICAL RECORDING STATIONS IN REMOTE AREAS,
McGill Univ., Montreal (Quebec).
F. Muller.

roceedings of Canadian Hydrology Symposium o 7, Victoria, British Columbia, scheduled for ay 14u15, 1969; held Oct 8-9, 1969, National esearch Council of Canada, Subcommittee on ydrology, p 205-217, Vol 1, 1969. 13 p, 3 fig, 2 b, 8 ref.

escriptors: *Logging (Recording), *Data collec-ons, *Meteorological data, *Climatic data, elemetry, Arctic, Cold regions, Rain gages, recipitation gages, Snowfall, Temperatures, inds, Humidity, Solar radiation.
entifiers: Canada, Air pressure.

me experience with two types of automatic cli-atological stations, established in a glacierized sin of the Canadian High Arctic, is presented as example of one of their many applications in mote areas. Some other designs are also viewed, and the need for further development of otection against the severity of the environment stressed. (Knapp-USGS)
70-08617

YDROMETEOROLOGICAL AUTOMATIC ELEMETERING STATIONS,
eteorological Service of Canada, Toronto (On-rio).
. C. Belhouse, D. W. Colwell, and J. S. Dickson.
roceedings of Canadian Hydrology SYMPOSIUM o 7, Victoria, British Columbia, scheduled for ay 14-15, 1969; held Oct 8-9, 1969, National esearch Council of Canada, Subcommittee on ydrology, p 189-203, Vol 1, 1969. 15 p, 5 fig.

escriptors: *Telemetry, *Data transmission, Data collections, *Hydrologic data, Meteorologi-l data, Instrumentation, Design, Network design, quipment, Research and development, Precipita-on gages, Stream gages, Water levels, Columbia ver Basin.
entifiers: Canada.

ne activities of the Canadian Meteorological anch in the field of hydrometeorological auto-atic telemetering stations, particularly in respect those stations required at remote mountain loca-ons in the Columbia Basin are reviewed. The urse of events is pursued from initial experiments assess the challenge of this formidable Canadian vironment, through the design evolution stage of peated development and mountain testing, to the rrent stage of a working model that now thstands the environment and provides a sub-antial performance capability. Unsuccessful sign approaches are recounted to identify what pear to be blind alleys, and the more promising rection and applications of final prototype equip-ent are suggested. (Knapp-USGS)
70-08618

PPLICATIONS OF SATELLITE PHOTO-RAPHS TO HYDROLOGY IN CANADA,
epartment of Transport, Toronto (Ontario). eteorological Branch.
. L. Ferguson, H. F. Cork, and A. D. J. O'Neill.
roceedings of Canadian Hydrology Symposium o 7, Victoria, British Columbia, scheduled for ay 14-15, 1969p held Oct 8-9, 1969, National esearch Council of Canada, Subcommittee on ydrology, p 311-343, Vol 1, 1969. 33 p, 11 fig, 4 b, 36 ref.

escriptors: *Satellites (Artificial), *Aerial notography, *Hydrologic data, *Surveys, Water sources, Snow surveys, Meteorology, ydrogeology, Glaciers, Thawing, Mapping.
entifiers: Canada.

ne latest developments in weather satellite chnology and the application of satellite photo-aphs to hydrology are reviewed. A comparison of tellite observations versus conventional observa-ons over Canada is made, based on data collected ver at least one winter. This comparison deals ecifically with basin snow cover, large scale ow-line observations and the break-up and freeze-up of large lakes. Weather satellite photographs are available in Canada on a routine basis and provide up-to-date pictures of the earth's surface as well as of cloud formations. While the photographs are used in many countries for weather analysis and forecasting, routine use of this new data source for hydrological purposes is still in the research and development stage. (Knapp-USGS)
W70-08622

RADAR AS A REMOTE SENSOR FOR HYDROLOGY,
McGill Univ., Montreal (Quebec). Dept. of Physics.
J. S. Marshall, and P. E. Carlson.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 261-281, Vol 1, 1969. 21 p, 9 fig, 1 tab, 11 ref.

Descriptors: *Remote sensing, *Precipitation (Atmospheric), *Radar, Synoptic analysis, Distribution patterns, Rainfall disposition, Weather, Climatology, Data collections, Weather patterns, Mapping.
Identifiers: Canada.

Radar yields a map over a large area, for a layer of atmosphere above the earth's surface, of the Radar parameter Z. There is a statistical relationship between Z and R, the rate of precipitation. For any single point on the map, radar can measure R to within 25 percent, and there is an uncertainty of 50 percent in the relation of Z to R. Expanding from a point to an area, performance improves considerably. Also, expanding from rate at an instant to amount over a period of time improves performance. Apart from use as a gage radar can give a very detailed qualitative pattern. (Knapp-USGS)
W70-08625

CONTENT OF TRACE ELEMENTS IN PRECIPITATION,
Main Geophysical Observatory, Liningrad (USSR); and Institute of Experimental Meteorology, Obninsk (USSR).
V. M. Drozdova, and E. P. Makhon'ko.
Journal of Geophysical Research, Vol 75, No 18, p 3610-3612, June 20, 1970. 2 tab, 12 ref.

Descriptors: *Trace elements, *Chemistry of precipitation, *Precipitation (Atmospheric), Sampling, Data collections, Manganese, Iron, Spectroscopy, Distribution patterns.
Identifiers: Nickel, Lead, USSR.

Seventy-five combined monthly precipitation samples collected in 1968-1969 at stations in the north, northwest, and central regions of the European territory of the Soviet Union were analyzed. Annually averaged maximum and minimum concentrations of manganese, nickel, lead, and iron in precipitation are given, as well as mean concentrations of the same elements during cold and warm periods for regions of the European territory of the USSR. (Knapp-USGS)
W70-08940

MODEL FOR CAPTURE OF RADIOACTIVITY BY PRECIPITATION,
Institute of Experimental Meteorology, Obninsk (USSR).
A. S. Avramenko, and K. P. Makhon'ko.
Journal of Geophysical Research, Vol 75, No 18, p 3613-3622, June 20, 1970. 8 fig, 21 ref.

Descriptors: *Radioisotopes, *Precipitation (Atmospheric), *Mathematical models, *Fallout, *Chemistry of precipitation, Dusts, Cloud physics, Sampling, Particle size.
Identifiers: Rainout chemistry.

A rough scheme for radioactive dust particle capture by rain droplets is presented. Processes taking place both within the cloud with regular updrafts and in the layer of the atmosphere below the cloud that lead to a definite distribution of specific radioactivity with droplet size are considered. Comparison of experimental data on the fission-product concentration in raindrops of different sizes with theoretical calculations allowed determination of the coefficient of rainout for removal of radioactive particles by cloud drops, corresponding to an inverse proportionality between concentration and cloud drop radius. The functional dependence obtained theoretically is in good agreement with the experimental data. The influence of the specific radioactivity distribution versus droplet size on the variation of the specific radioactivity during a short-range shower is considered. (Knapp-USGS)
W70-08941

STRONTIUM 90 FALLOUT DISTRIBUTION AT MIDDLE LATITUDES OF THE NORTHERN AND SOUTHERN HEMISPHERES AND ITS RELATION TO PRECIPITATION,
Institute of Experimental Meteorology, Obninsk (USSR). Hydrometeorological Service.
S. G. Malakhov, and I. B. Pudovkina.
Journal of Geophysical Research, Vol 75, No 18, p 3623-3628, June 20, 1970. 5 fig, 3 tab, 3 ref.

Descriptors: *Fallout, *Chemistry of precipitation, *Data collections, *Strontium radioisotopes, Sampling, Precipitation (Atmospheric), Synoptic analysis, Data collections, Mathematical models, Statistical models.
Identifiers: Radiological networks, USSR.

The dependence of Sr-90 deposition on precipitation within each 10 deg latitude belt was investigated. No satisfactory linear correlation was found for undifferentiated measurements obtained under different climatic conditions. Regions in which the data deviate systematically from the general trend of results in each latitude belt are singled out. A satisfactory linear correlation for most of the data was obtained between 50 and 60 deg N and for the first and second quarters between 30 and 40 deg N and 40 and 50 deg N. The third quarter is characterized by the largest deviations of the results from a linear dependence. The regression equations for the dependence of Sr-90 deposition on precipitation in each latitude belt are given. (Knapp-USGS)
W70-08942

THE POSSIBILITY OF INTERPRETING THE DATA OF A SEDIMENTATION ANALYSIS,
M. M. Kokhanovich, and V. G. Morachevskiy.
For sale by Clearinghouse, Springfield, Va - Price $3.00. Transl from 'Problemy Fiziki Atmosfery Sbornik 5.' Leningrad State Univ Press, 1967. In: Problems of Atmospheric Physics, Collection 5, National Aeronautics and Space Administration Technical Translation Report NASA TT F-587, p 261-264, June 1970. 4 p, 4 fig, 6 ref.

Descriptors: *Precipitation (Atmospheric), *Raindrops, *Cloud physics, *Statistical methods, *Microscopy, Photography, Analytical techniques, Model studies, Statistical models.
Identifiers: Water-drop sedimentation.

A study was made of the distribution of drops in modeled nebula obtained by a sedimentation analysis and by the microphotographic method. The sedimentation method of analyzing the degree of dispersion of a modeled nebula gives a completely clear and precise representation of the distribution of drops by size. (Knapp-USGS)
W70-09010

2C. Snow, Ice, and Frost

GLACIER DISCHARGE SIMULATION,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
A. L. Derikx.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 143a, 1969. 1 p.

Descriptors: *Simulation analysis, *Glaciers, *Ablation, *Water yield, *Streamflow forecasting, Water balance, Melting, Precipitation (Atmospheric), Percolation, Runoff, Energy budget, Synthetic hydrology, Mathematical models.
Identifiers: Glacier discharges, Canada.

The flow of water from glacier drainage basin is defined by differential equations with boundary conditions similar to those of non-steady groundwater flow. Field data from Peyto Glacier, Alberta, Canada, are analyzed. In the heat balance only four terms have been considered: net radiation flux, sensible heat flux, latent heat flux and the heat available for melting snow and ice. The glacier is regarded as a lumped, linear system and meltwater is considered to percolate into this reservoir. The computation of outflow rates follows methods for non-steady groundwater flow to parallel drains based on the linearized Boussinesq's equation. One single parameter, defined as 'reservoir coefficient,' incorporates all hydrological properties of the glacier drainage situation. The principle of superimposition can be used to compute variations of outflow rate caused by variation of percolation. (Knapp-USGS)
W70-08608

2D. Evaporation and Transpiration

EVAPORATION IN TENNESSEE RIVER BASIN, 1935-1969.
Tennessee Valley Authority, Knoxville.

Tennessee Valley Authority Hydraulic Data, Branch Report No 0-6862, May 1970. 59 p, 2 plate, 4 tab.

Descriptors: *Evaporation, *Tennessee Valley Authority Project, Evaporation pans, Climatology, Data collections, Hydrologic data, Water balance.
Identifiers: Tennessee River Basin.

During the 35-year period 1935 through 1969, the Hydraulic Data Branch of the Tennessee Valley Authority observed daily evaporation and associated data at several land-pan stations in the Tennessee River Basin. Records of these observations are given in this report. Observations are made once daily between 7 and 8 a.m. during the months of April through October and between 4 and 5 p.m. during the period November through March. The afternoon observation time during the winter was set to permit natural melting of ice that covers the pan on cold mornings. The variation in mean annual evaporation from one end of the Valley to the other averages about 10 inches. The highest evaporation, 46 to 53 inches, occurs in the western part of the Valley and the lowest, 38 to 40 inches, in the North Carolina mountains. Evaporation in the east-central portion, as measured at the Norris and Jefferson City stations, is between these two limits. The principal difference in factors affecting evaporation is wind velocity. (Knapp-USGS)
W70-08586

WATER BALANCE IN NORTH AMERICA,
For primary bibliographic entry see Field 02A.
W70-08597

AN AVERAGE WATER BALANCE FOR CANADA,
Windsor Univ. (Ontario).
For primary bibliographic entry see Field 02A.
W70-08599

LOCAL VARIATION IN EVAPOTRANSPIRATION,
British Columbia Univ., Vancouver. Dept. of Forestry.
Bertram C. Goodell.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 110-115, 1969. 6 p, 12 ref.

Descriptors: *Evapotranspiration, *Distribution patterns, Topography, Winds, Meteorology, Climates, Precipitation (Atmospheric), Vegetation effects. Soil properties, Water storage, Soil water, Water balance, Advection, Consumptive use, Energy budget, Environmental effects.
Identifiers: Aerodynamic roughness.

Rate of evapotranspiration depends on the degree of confluence in time and space of three variables: water availability, energy supply, and surface ventilation. Within a topographically and vegetatively rough landscape, such as a typical watershed, each of these variables varies widely. Water availability is a function of precipitation characteristics, both temporal and spatial, as well as soil and vegetation characteristics as they affect storage. Local variations in energy supply are largely topography, vegetation and soils. Ventilation is a function of topographic position and surface roughness. Spatial variation in factors causative of evapotranspiration render its accurate evaluation impossible by present methods. Current reliance must be placed on approximations and relative magnitude evaluations. Several approaches to these are reviewed. (Knapp-USGS)
W70-08604

LOCAL VARIATIONS IN THE WATER BALANCE: GEOLOGIC FACTORS,
University of Western Ontario, London. Dept. of Geology.
Robert N. Farvolden.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 116-121, 1969. 6 p, 20 ref.

Descriptors: *Water balance, *Hydrogeology, *Geology, Surface-groundwater relationships, Aquifers, Groundwater basins, Groundwater movement, Discharge (Water), Evapotranspiration, Permeability, Transmissivity, Recharge, Water storage.
Identifiers: Inter-basin groundwater flow, North America.

The items in the water-balance equation that are most influenced by sub-surface geology are interbasin movement of groundwater and evapotranspiration. Interbasin flow of groundwater can be expected in any region underlain by highly permeable materials and it can be easily recognized where water table contours do not match the surface topography. Analytical techniques for the solution of these flow systems are now available. The pertinent parameters are the distribution and properties of the hydrostratigraphic units in the sub-surface, the geometry of the system, and the configuration of the water table. Subsurface geology has an important influence on evapotranspiration loss where it is the factor responsible for maintaining a high water table, particularly during long droughts, because evapotranspiration rate varies considerably according to the depth of the water table. Favorable conditions occur wherever shallow, river-connected aquifers support a heavy cover of phreatophytes and in areas of groundwater discharge. (Knapp-USGS)
W70-08605

WATER UPTAKE BY ORCHARDGRASS AND EVAPORATION FROM BARE SOIL IN THE PRESENCE OF SHALLOW WATER TABLES,
Department of Agriculture, Lethbridge (Alberta) Research Station.
J. C. van Schaik, and K. K. Krogman.
Canadian Journal of Soil Science, Vol 48, No 3, p 281-288, October 1968. 2 fig, 1 tab, 9 ref.

Descriptors: *Orchardgrass, *Moisture uptake, *Evapotranspiration, *Soil moisture, *Saline soils, Water table, Water level, Evaporation, Moisture content, Water loss, Grasses, Forage grasses, Semiarid climates, Transpiration, Fallowing, Soil surfaces.
Identifiers: *Alberta (Canada), *Salinization, *Bare fallow, Potential evapotranspiration.

Studies from June 16 to September 15, 1967 with 12 non-weighing lysimeters showed that orchardgrass (Dactylis glomerata) ET was 38.8, 37.2, and 34.9 cm with water tables at depths of 91, 122, and 152 cm, respectively. The measured ET due almost entirely to transpiration, represented 60 percent of the estimated potential ET. Surface salt concentration was not influenced by evaporation from bare soil in 1967. Barring fluctuation of the water table, salinization of cropped soil should principally occur outside the growing season. Since salinization would not take place without plant cover, use of bare fallow should retard salt movement and salinization of surface soil. (Carr-Arizona)
W70-08820

THERMAL LOADING IN DUNKIRK HARBOR,
State Univ. Coll., Fredonia, N.Y.
For primary bibliographic entry see Field 05B.
W70-08838

SOME RECENT RESEARCH IN EVAPORATION SUPPRESSION,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 03B.
W70-08993

2E. Streamflow and Runoff

DRAINAGE AREAS FOR STREAMS IN TENNESSEE RIVER BASIN.
Tennessee Valley Authority, Knoxville.

Tennessee Valley Authority, Hydraulic Data Branch Report No 0-5829-R-2, March 1970. 11 p, 2 plate, 16 tab.

Descriptors: *Tennessee Valley Authority Project, *Watersheds (Basins), *Size, *Areal, Dimensions, Mapping, Maps, Surfaces.
Identifiers: *Tennessee River Basin, Drainage areas.

Drainage areas range in size from a few acres to 40,910 square miles in the Tennessee River Basin. Drainage areas for streams were measured on TVA planimetric and topographic maps, scale 1 inch = 2000 feet. An index of all sites in alphabetical order of stream name shows watershed and page reference. (Knapp-USGS)
W70-08588

WATER BALANCE IN NORTH AMERICA,
For primary bibliographic entry see Field 02A.
W70-08597

WATER BALANCE PATTERNS IN THE CONTINENTAL UNITED STATES,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02A.
W70-08600

STREAMFLOW DISTRIBUTION PATTERNS IN MEXICO,
Secretariat of Hydraulic Research (Mexico); and Geological Survey, Tucson, Ariz.
Fernando del Rio, and Alfonso Wilson.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 62-73, 1969. 12 p, 8 fig, 2 tab, 9 ref.

Descriptors: *Water balance, *Regions, Hydrologic budget, Precipitation (Atmospheric), Rainfall, Rainfall-runoff relationships, Streamflow, Runoff, Evapotranspiration, Irrigation water.
Identifiers: *Mexico.

Half of Mexico lies in the temperate and half in the intertropical zone. Mountain ranges parallel the two coasts, and an intermontane plateau occupies almost the entire intervening area. Arid and semiarid regions comprise almost two-thirds of the country's 2-million odd square kilometers. True desert occupies only 4 percent of the area, while 7 percent is humid or very humid. Winter frontal precipitation is relatively unimportant. Summer precipitation occurs as short, intense storms. Even where annual precipitation appears abundant, it occurs mostly during the non-growing season. Annual precipitation ranges from almost zero to 5,000 mm and averages 704 mm. The total volume of precipitation is 1,408 billion cu m. The total runoff to the sea and to international streams is 349.5 cu m. Surface runoff amounts to only 25% of precipitation and loss to evapotranspiration is 75% of precipitation. The net volume of water used in irrigation is about 1 1/2% of the precipitation and about 6% of the runoff. (Knapp-USGS)
W70-08601

HYDROMETRIC SURVEYS,
Shawinigan Engineering Co. Ltd., Montreal (Quebec).
S. I. Solomon.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 125-136, 1969. 12 p, 1 fig, 3 tab, 7 ref.

Descriptors: *Hydrologic data, *Hydrography, *Data collections, *Surveys, *Networks, Regions, Gaging stations, Water balance, Meteorological data, Distribution patterns, Surface waters, Groundwater, Soil water.
Identifiers: Hydrometric surveys, North America.

From about 12,000 gaging stations which are or have been in operation in North America, it is now possible to draw at least an approximate picture of the average water availability and to roughly estimate other hydrologic characteristics. However, because of the extreme variation in network density and the vastness and variety of the terrain, there are areas with inadequate hydrometric coverage. A similar situation exists for the meteorologic networks which to a large extent have been developed independently of the hydrometric networks, but followed a similar pattern. Further expansion of the present network therefore appears imperative in some areas, while reduction of the density may be possible in other areas. The use of computers, satellites, and other related technological development will facilitate the collection, processing, and retrieving of hydrologic information in a more comprehensive way than in the past. (Knapp-USGS)
W70-08606

AREAL EXTENSION OF STREAMFLOW INFORMATION BY MULTIPLE-REGRESSION TECHNIQUES,
Geological Survey, Washington, D.C. Surface Water Branch.
Manuel A. Benson, and Rolland W. Carter.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 137-143, 1969. 7 p, 2 fig, 1 tab.

Descriptors: *Streamflow forecasting, *Hydrologic data, *Data processing, *Regression analysis, Statistical methods, Gaging stations, Networks, Surveys, Streamflow, Discharge (Water), Planning, Water resources development, Data collections.
Identifiers: Multiple regression analysis.

Definition of the natural streamflow in all streams, gaged or ungaged, is one of the principal objectives of a streamflow information program. Multiple regression analyses are used to provide general definition of natural streamflow. The streamflow characteristics that may be generalized are used in planning and design; they are indices of high, low and medium flows, and also of the distribution of flows in time. Numerous topographic and climatic indices are used to describe the watershed and its environment above the site of each flow record. Multiple regression analyses then relate each flow characteristic to the effective basin characteristics. The result is in the form of generalized equations for estimating flow characteristics at any site, gaged or ungaged. The analyses also provide measures of the accuracy of each relation. Examples are given of results of such studies. (Knapp-USGS)
W70-08607

INSTRUMENTATION AND OBSERVATION TECHNIQUES.
For primary bibliographic entry see Field 07B.
W70-08611

SURFACE WATER,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
E. R. Peterson.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Sub-Committee on Hydrology, p 59-80, Vol 1, 1969. 22 p, 1 tab, 8 ref.

Descriptors: *Instrumentation, *Stream gages, *Surface waters, Discharge measurement, Flowmeters, Tracking techniques, Remote sensing, Telemetry, Gaging stations, Streamflow, Velocity, Water levels, Aerial photography, Data processing.
Identifiers: Surface water instrumentation, Canada.

Methods for the measuring, recording and calculating of water levels, current velocities, water depths, and flow volumes are described with special emphasis on the advantages and disadvantages inherent in each of the measurement techniques. Techniques discussed include bubbler systems, closed pressure systems, and float systems for water level recording; current meter measurements and dilution methods for flow measurements; and sounding equipment, weirs, flumes, spillways, and turbines. Some emphasis is placed on the effects of Canada's variable climate on instrumentation and measurement techniques. The use of indirect methods such as maximum gages and other types of partial record stations are examined. Recent and possible future developments such as leasing edge current meters, velocity measurements by aircraft (Russia) and the use of digital recorders and automatic plotters or chart readers as part of the automation of data processing are surveyed. Solutions for winter instrumentation and observation techniques are discussed. (Knapp-USGS)
W70-08615

AUTOMATIC HYDROLOGICAL DATA COLLECTING STATIONS,
Department of Energy, Mines and Resources, Ottawa (Ontario). Marine Sciences Branch.
For primary bibliographic entry see Field 07B.
W70-08620

PHOTOGRAPHIC REMOTE SENSING FOR HYDROLOGY,
Guelph Univ. (Ontario).
For primary bibliographic entry see Field 07C.
W70-08621

REMOTE SENSING BY INFRA-RED TECHNIQUES,
Department of Transport, Toronto (Ontario). Meteorological Branch.
For primary bibliographic entry see Field 07B.
W70-08623

TRACER TECHNIQUES IN HYDROLOGY,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 07B.
W70-08624

FLOOD ROUTING USING A CONVECTIVE DIFFUSION MODEL,
Birmingham Univ. (England). Dept. of Civil Engineering.
I. E. Thomas, and P. R. Wormleaton.
Civil Engineering and Public Works Review, Vol 65, No 764, March 1970, p 257-259. 6 fig, 5 ref.

Descriptors: *Flood routing, *Streamflow, Hydrology, Hydraulics, *River systems, Design.
Identifiers: *Convective diffusion model, River Dee, North Wales.

An alternative routing procedure resulting from a recognition of the similarity of the flood wave profile to the transient concentration distribution curve for a mass of material diffusing in a stream flow was discussed. In its one dimensional form the convective diffusion model of the wave phenomenon was described. The usual methods for routing floods through open channels are the 'hydraulic' and 'hydrological' approach which was mentioned. The general research programme of the Water Resources Board on the regulation of the River Dee in North Wales provided an opportunity for testing the application of the diffusion routing method to a real river system. The general river configuration between Glyndyfrowy and Erbistock together with the positions of tributaries, gauging stations and sub-catchment boundaries were shown. Details of representative floods analyzed were given. Results of considering a flood sequence as a whole and routing the inflows using values of dispersion obtained by a simple averaging of the values for its component peaks were shown. (Kriss-Cornell)
W70-08848

A NOTE ON THE CELERITY OF WIND WAVES ON A WATER CURRENT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Erich Plate, and Michael Trawle.
Journal of Geophysical Research, Vol 75, No 18, p 3537-3544, June 20, 1970. 5 fig, 3 tab, 11 ref. Grant GK-2142 (NSF) and Grant AT911-L)-1813 AEC.

Descriptors: *Waves (Water), *Winds, *Currents (Water), *Hydraulic models, Laboratory tests, Model studies, Wind velocity, Flumes.
Identifiers: Wind tunnel tests.

Measurements were made of water surface velocities and phase speeds of the dominant waves in fields of gravity waves at the interface between parallel streams of air and water moving either in the same or in opposite directions. Velocities in the air flow were correlated with those in the water current. The phase velocity depends on the water surface velocity, and it is concluded that the Airy wave theory gives values which are too low. An attempt is made to explain the results in terms of Biesel's model for wave motion on moving water with a linear velocity gradient. (Knapp-USGS)
W70-08936

A THREE COMPONENT DRAG PROBE FOR THE MEASUREMENT OF TURBULENT WATER VELOCITY FLUCTUATIONS,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 07B.
W70-08938

INTERCHANGE OF WATER BETWEEN THE MAJOR OCEANS,
Lamong-Doherty Geological Observatory, Palisades, N.Y.
Wallace S. Broecker, and Yuan-Hui Li.
Journal of Geophysical Research, Vol 75, No 18, p 3545-3552, June 20, 1970. 5 fig, 1 tab, 23 ref. Contract No AT (30-1)2663 AEC.

Descriptors: *Ocean circulation, *Water chemistry, *Tracking techniques, Stable isotopes, Oceans, Radioisotopes, Water circulation, Ocean currents, Currents (Water), Oceanography, Water temperature, Calcium carbonate, Chemical precipitation, Sedimentation rates.
Identifiers: Ocean water interchange.

A three-box model is used to evaluate the rate of exchange of water between the three major water types in the ocean: warm surface water, North Atlantic deep water, and Pacific and Indian deep water. The eight unknown fluxes (six for water and two for particles) are determined from material balance considerations for H2O, C-14, and total CO2 and from the requirement that the relationships between 0-18 and salinity observed in the ocean are not to be violated. The validity of the model is checked by comparing the predicted and observed rates of CaCO3 accumulation in deep-sea sediments. (Knapp-USGS)
W70-08939

WATER INVENTORY STUDIES IN THE UNITED STATES AND THE I.H.D. PROGRAM,
National Committee for the International Hydrological Decade, Washington, D.C.
L. A. Heindl.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 299-302, 1969.

Descriptors: *Surveys, *Water resources, *United States, *International Hydrological Decade, Groundwater, Surface waters, Water resources development, Water supply, Water balance, Hydrology, Hydrography, Mapping, Data collections, Hydrologic data.
Identifiers: *National Water Atlas (US).

Water inventories in the United States are made largely on the basis of data compiled from federal networks of climatological, surface-water, groundwater, sediment-discharge, and chemical quality stations. These data are supplemented by data from state and special-purpose networks, including those of experimental and representative basins, snow courses, glacial and lysimeter stations, and lake-level gages. Water inventory studies usually are in the forms of water budgets or water balances. A proposal to present the principal elements of the hydrological regimen on uniform time and space scales for the 17 major basins of the conterminous United States and for all of the United States and its territories--a national water atlas--is now being reviewed. Large masses of data have been collected in the United States, but they have never been compiled in a unified way. The national water atlas is a proposal to compile these data so as to make them available for scientific analysis, education, planning of future studies, and the management of water resources as an integral part of our natural environment. (See also W70-08597)
W70-09001

CANADIAN RESEARCH,
National Committee for the International Hydrological Decade, Ottawa (Ontario).
Ira C. Brown
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 303-307, 1969.

Descriptors: *Surveys, *Water resources, *International Hydrological Decade, Groundwater, Surface waters, Water resources development, Water supply, Water balance, Hydrology, Hydrography, Mapping, Data collections, Hydrologic data, Glaciers.
Identifiers: *Canada, *National Hydrological Atlas (Canada).

Canada's International Hydrological Decade program of 211 projects includes most of the research effort relating to water balance. Nearly all projects are cooperative with from 3 to 14 participating agencies. In 1968 the program represented a total investment of $4.75 million with universites coordinating 61 projects, provincial agencies 65 and federal agencies 85. The organization to promote and coordinate this program is described, together with the method of funding and the programs for exchange of information and education. Inventories of glaciers and lakes are well under way and the Hydrological Atlas of Canada is in preparation. International cooperative efforts involve coordination with the United States of Decade stations along our border, inclusion of 7 glacier basins in worldwide chains, and the Canadian/United States International Field Year on the Great Lakes program, an intensive 18-month study of Lake Ontario. (See also W70-08597)
W70-09002

FLOOD OF APRIL 1968 AT MANY, LOUISIANA,
Geological Survey, Washington, D.C.
Alfred S. Lowe.
For sale by U S Geological Survey, Wash, D C 20402 - Price $0.50. U S Geological Survey Hydrologic Investigations Atlas HA-374, 1 sheet, 1970. Text, 7 fig, 1 map, 3 tab, 4 ref.

Descriptors: *Floods, *Louisiana, *Cloudbursts, Profiles, Maps, Mapping, Frequency analysis, Rainfall-runoff relationships, Stage-discharge relations, Discharge (Water), Storm runoff, Historic flood, Peak discharge.
Identifiers: Many (La).

On April 8-9, 1968, an almost stationary line of thunderstorms from 50 to 75 miles wide produced torrential rains in the northern half of Louisiana. The greatest rainfall of the storm, 12.48 inches, fell in the Many area and caused flooding in and around Many. The approximate area of inundation caused by the four streams that surround Many--Harpoon Bayou, Phillips Creek, Blackwell Creek, and San Jose Creek--is shown on a photomosaic map. Most of the flooded area was under water for less than 24 hours. This report presents hydrologic data that can be used to evaluate the extent and frequency of flooding that affect the economic development of flood plains in the Many area. It will aid individuals, government agencies, and others responsible for solving existing flood problems. The report will also be useful for preparing building and zoning regulations, locating waste disposal facilities, and developing recreational areas. (Knapp-USGS)
W70-09008

2F. Groundwater

LOCAL VARIATIONS IN THE WATER BALANCE: GEOLOGIC FACTORS,
University of Western Ontario, London. Dept. of Geology.
For primary bibliographic entry see Field 02D.
W70-08605

NEW TECHNIQUES IN THE SEARCH FOR WATER IN LIMESTONE,
Auburn Univ., Alabama. Water Resources Research Inst.; and Alabama State Geological Survey, University.
James C. Warman, Philip E. LaMoreaux, and Thomas J. Joiner.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 144-146, 1969. 3 p

Descriptors: *Surveys, *Hydrogeology, *Limestones, *Carbonate rocks, *Alabama, Karst, Aquifers, Groundwater, Groundwater movement, Hydrologic budget, Recharge, Discharge (Water), Water supply, Hydrologic data, Data collection, Water levels, Water yield.
Identifiers: Limestone aquifers.

In research on the hydrology of the limestone terrane in north Alabama geological, geophysical, and geochemical techniques are used. In addition to more conventional methods, newer methods such as aerial photography are used to help define the lithologic and structural character of the rocks and the hydrologic system. Comprehensive evaluation enhances the probability of determining favorable areas for development of groundwater. Wells drilled in areas deemed favorable on the basis of techniques applied in this research are significantly more productive than wells drilled in other areas. (Knapp-USGS)
W70-08609

DECODING AERIAL PHOTOGRAPHS OF GLACIAL LANDSCAPES - INDICATORS OF GROUNDWATERS,
For primary bibliographic entry see Field 07B.
W70-08610

INSTRUMENTATION AND OBSERVATION TECHNIQUES.
For primary bibliographic entry see Field 07B.
W70-08611

GROUNDWATER INSTRUMENTATION AND OBSERVATION TECHNIQUES,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
J. A. Gilliland.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, National Research of Canada, Subcommittee on Hydrology, p 37-57 Vol 1, 1969. 21 p, 10 fig, 22 ref.

Descriptors: *Instrumentation, *Groundwater, *Hydrogeology, *Groundwater movement, *Aquifers, Sampling, Telemetry, Observation wells, Geophysics, Borehole geophysics, Radioactivity techniques, Tracers, Tracking techniques, Piezometers, Piezometry, Seismic studies, Electrical studies, Data processing, Data storage and retrieval, Data transmission.
Identifiers: Groundwater instrumentation, Canada.

Rapid changes in the sophistication of groundwater measuring techniques have taken place during the past five years. A brief review presents the standard measuring techniques in groundwater hydrology followed by an extensive survey of more modern techniques. Groundwater flow measurement may be made by observation wells. The equipment and techniques for such measurement include installation of piezometers and the use of pressure transducers. Observation wells can be used as seismometers to yield aquifer parameters. Geophysical techniques are applied to groundwater studies. They include electrical and radioactive methods of borehole logging, along with surface methods of geophysical surveying for aquifers, including seismic, gravity, resistivity, and electromagnetic methods. Equipment digitization methods for data storage and transmission include telemetering and remote collection of data and use of computers i

data processing. Techniques and equipment for sampling the quality of groundwaters and determination of fluid potentials include packers and sampling devices. (Knapp-USGS)
W70-08614

REMOTE SENSING GEOPHYSICAL APPLICATIONS TO HYDROLOGY,
Geological Survey of Canada, Electrical Methods Section.
L. S. Collett.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 237-260, Vol 1, 1969. 24 p, 12 fig, 1 tab, 18 ref.

Descriptors: *Remote sensing, *Hydrogeology, *Aquifers, *Groundwater, Saline water intrusion, Geophysics, Electrical studies, Magnetic studies, Subsurface mapping.
Identifiers: Canada, Airborne geophysical surveys.

The presence of groundwater is related to geology and geological structures, which can nearly always be characterized locally by the electrical parameters of conductivity and dielectric constant. Conductivity exhibits by far the largest variations of its magnitude for various rock materials. Structures which contain fresh water will always exhibit a fairly low conductivity. Through the mapping of these properties by remote sensing geophysical techniques can be applied to hydrology. Where the host structures are shallow, airborne VLF (Very Low Frequency) systems look promising for detecting variations in ground conductivity. For the deeper case where faulting and shear zones contain water in the fractures, audio frequency magnetics is presently being applied. A conventional airborne EM system is used for resistivity mapping of geological structure and salt-water intrusions. (Knapp-USGS)
W70-08619

TRACER TECHNIQUES IN HYDROLOGY,
Guelph Univ. (Ontario). Dept. of Soil Science.
For primary bibliographic entry see Field 07B.
W70-08624

HUEY V STATE (NO RIGHT TO DAMAGES FOR DIVERSION OF UNDERGROUND WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W70-08790

INFILTRATION RATES IN SOILS OF THE EDMONTON AREA AND RAINFALL INTENSITIES,
Alberta Univ., Edmonton. Dept. of Soil Science.
For primary bibliographic entry see Field 02G.
W70-08819

GROUNDWATER FLOW SYSTEMS AND ACCUMULATION OF EVAPORITE MINERALS,
Idaho Univ., Moscow. Coll. of Mines.
Roy E. Williams.
American Association of Petroleum Geologists Bulletin, Vol 54, No 7, p 1290-1295, July 1970. 2 fig, 30 ref.

Descriptors: *Reviews, *Bibliographies, *Groundwater movement, *Geochemistry, *Chemical precipitation, Water quality, Groundwater basins, Water circulation, Permeability, Sedimentary rocks, Flow, Evaporation, Convection, Porous media, Discharge (Water), Recharge, Solutes, Aqueous solutions.
Identifiers: Evaporite deposits.

The literature on evaporite mineral deposits suggests a functional relation between the origin of these deposits and groundwater flow systems. Comparison of reported spacial variations of groundwater quality with pertinent solutions to flow equations under specified boundary conditions reveals that quality of groundwater is a function of flow-path length, flow-path route and flow velocity. Selected references provide evidence that sites of accumulation of nonmarine evaporite minerals are discharge zones for poor-quality water from regional or intermediate groundwater flow systems. Reported isotope ratios in oil field brines and standard mean ocean water indicate that water in some deep brines is of meteoric origin; therefore, such brines must be part of a groundwater flow system. Similarly, fluid potential values in the saline parts of certain groundwater flow systems along the Atlantic Coast of the United States reveal that saline groundwater in such systems discharges toward the ocean floor. Therefore, groundwater flow systems act as transport agents for dissolved solids which under appropriate geomorphic and climatic conditions, are contributed to marine evaporite deposits. (Knapp-USGS)
W70-08935

LAND-SURFACE TILTING NEAR WHEELER RIDGE, SOUTHERN SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 08E.
W70-08953

STORAGE AND HYDROLOGIC PROCESSES,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
For primary bibliographic entry see Field 02A.
W70-08987

WATER INVENTORY STUDIES IN THE UNITED STATES AND THE I.H.D. PROGRAM,
National Committee for the International Hydrological Decade, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-09001

CANADIAN RESEARCH,
National Committee for the International Hydrological Decade, Ottawa (Ontario).
For primary bibliographic entry see Field 02E.
W70-09002

2G. Water in Soils

FACTORS AFFECTING PERCOLATION IN A FOREST SOIL,
Washington Univ., Seattle. Coll. of Forest Resources.
Dale W. Cole, and Peter S. Machno.
Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association publication, Urbana, Illinois, p 101-109, 1969. 9 p, 2 tab, 18 ref.

Descriptors: *Water balance, *Infiltration, *Soil water movement, *Forests, Model studies, Mathematical models, Hydrograph analysis, Base flow, Consumptive use, Evapotranspiration, Water yield improvement, Forest management, Water storage, Soil water.
Identifiers: Soil water storage.

Specific factors affecting the water balance in a forest ecosystem are examined both theoretically and through actual field measurements. The variety of techniques that have been devised to evaluate soil water flow and retention are evaluated in regards to sensitivity and applicability. These techniques include theoretical models utilizing mathematical approaches and field techniques where measurements of soil moisture amounts and rates of flow are directly assessed. Specific examples illustrating the effects of horizontal layering, prior soil moisture conditions and pore distribution on soil water flow are cited. Sources of variability in the hydrograph characteristics of flow are examined using data from field measurements. For example, changes in flow rates as a function of depth and water use by plants are presented. Data illustrating changes in flow characteristics and total water yield following the removal of the forest canopy are also discussed. (Knapp-USGS)
W70-08603

SOIL MOISTURE,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
G. C. Topp.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969, held Oct 8-9; 1969, National Research Council of Canada, Subcommittee on Hydrology, p 21-36, Vol 1, 1969. 16 p, 47 ref.

Descriptors: *Instrumentation, *Soil water movement, Mass transfer, Nuclear moisture meters, Soil water, Soil moisture meters, Nuclear magnetic resonance, Flowmeters, Unsaturated flow.
Identifiers: Soil water flowmeters, Canada.

Recent advances or other techniques in soil-water measurement are discussed. Water content is a function of the pressure. A transfer of water depends on the pressure gradients in the soil. Tensiometric, vapor pressure and other methods of measuring water pressure or potential are described and evaluated with regard to laboratory and field studies. Water content determinations are improved by recent modifications in techniques involving neutron moderation and gamma ray attenuation. For small samples, nuclear magnetic resonance gives a reliable measure of water content. Two new methods make use of the water content dependent propagation of ultrasonic waves and the water content dependent 'fringe' capacitance. Two flowmeters for in situ flow rates are described and suggested for use in hydraulic conductivity determinations. (Knapp-USGS)
W70-08613

INVERSE FORMULATION AND FINITE DIFFERENCE SOLUTION TO PARTIALLY SATURATED SEEPAGE FROM CANALS,
Utah State Univ., Logan; and Computer Sciences Corp., Richland, Wash.
Roland W. Jeppson, and R. William Nelson.
Soil Science Society of America Proceedings, Vol 34, No 1, p 9-14, Jan-Feb 1970. 6 p, 2 fig, 12 ref.

Descriptors: *Unsaturated flow, *Seepage, *Canal seepage, Formulation, Steady flow, *Finite differences, Theory, Porous media, *Flow nets, Soil water movement, Equations, Mathematical analysis, Hydraulic conductivity.
Identifiers: Finite difference method, Computer applications, Porous media flow.

The mathematical model describing Darcian flow of water through soils approximates actual occurrences more closely when regions of the flow are permitted to be partially saturated. A generally accepted relationship between effective permeability and capillary pressure is utilized to formulate and solve by inverse methods with finite differences the steady-state flow system of water through soils. The inverse formulation considers the cartesian coordinates x and y as the dependent variables, and the potential function, phi, and the 2-dimensional stream function, psi, as the independent variables (the problem is solved for x and y in the phi-psi plane). The form of the solutions obtained from the inverse procedure is ideally adapted for plotting flow nets and obtaining other quantities such as hydraulic gradients, pressures, velocities, and relationships between capillary tension and moisture content anywhere within the flow field. A flow net for partially saturated seepage from a canal was obtained using the method and an electronic computer for the computations. (USBR)
W70-08679

INFILTRATION RATES IN SOILS OF THE EDMONTON AREA AND RAINFALL INTENSITIES,
Alberta Univ., Edmonton. Dept. of Soil Science.
T. R. Verma, and J. A. Toogood.
Canadian Journal of Soil Science, Vol 49, No 1, p 103-109, February 1969. 3 fig, 3 tab, 9 ref.

Descriptors: *Infiltration, *Soil types, *Rainfall intensity, *Vegetation effects, *Soil management, Runoff, Runoff forecasting, Impervious soils, Rainfall, Air-earth interfaces, Precipitation (Atmospheric), Erosion, Erosion control, Soil water, Groundwater, Semiarid climates.
Identifiers: *Infiltration rates, *Alberta (Canada), Edmonton sheet.

The major soil types in the vicinity of Edmonton, Alberta (Canada) were studied in order to determine their infiltration rates. Soils ranged from undisturbed to recently cultivated, from impervious to open and well-drained. Types of ground cover included fallow, grass, mixed forage, and grain. When rainfall intensity in the area was related to infiltration rates, it appeared that there was little likelihood of runoff from soils of the Edmonton sheet. On the Solonetzic soils, however, runoff might occur, although even this tendency would be counteracted by high initial infiltration rates. The total picture indicated a very slight runoff hazard during summer storms near Edmonton. Good soil management should properly protect local soils from water erosion during summer storms, although special problems might arise during spring runoff when the ground is frozen. (Carr - Arizona)
W70-08819

STORAGE AND HYDROLOGIC PROCESSES,
Saskatchewan Univ., Saskatoon. Div. of Hydrology.
For primary bibliographic entry see Field 02A.
W70-08987

2H. Lakes

FACTORS INFLUENCING PHOSPHATE USE BY ALGAE,
Minnesota Univ., Minneapolis. Limnological Research Center.
For primary bibliographic entry see Field 05C.
W70-08637

PHOSPHATES IN PEORIA LAKE: A QUANTITATIVE AND QUALITATIVE EVALUATION OF A NUTRIENT IN NATURAL WATERS,
Illinois State Water Survey, Peoria. Water Quality Section.
William T. Sullivan, and David L. Hullinger.
Transactions of the Illinois State Academy of Science, Vol 62, No 2, p 198-217, 1969. 5 fig, 14 tab, 33 ref.

Descriptors: *Phosphates, *Illinois, *Nutrients, Industrial wastes, Municipa' wastes, Agriculture, Runoff, Flow, Seasonal, Chemical analysis, Biological properties, Sampling, Load distribution.
Identifiers: *Peoria Lake (Ill), Illinois River, Orthophosphate, Polyphosphate, Organic phosphate.

Peoria Lake is situated midway between Chicago and the Mississippi River on the Illinois Waterway; its waters are substantially augmented by a variety of soluble and suspended materials from municipal and industrial wastes and from agricultural watersheds. A study of the chemical and biological characteristics of Peoria Lake was conducted during March-October 1967. Samples were collected on 25 dates from 9 stations at a standard 3-feet depth. Laboratory analysis of soluble and particulate fractions of ortho-, poly-, and organic phosphate forms has allowed evaluation of the various phosphates found in these natural waters. The phosphorus budget for the study period showed the mean daily phosphate load for all fractions and forms entering the lake to be 77,200 pounds; total phosphate leaving the lake was 63,400 pounds. The net phosphate apparently retained in Peoria Lake was calculated to be a mean of 13,800 pounds/day, or 17.9% of the influx. Possible mechanisms affecting this retention and distribution of the various fractions and forms are discussed. Although nutrient conditions appeared sufficient to support plankton populations, they were non-existent. (Jones-Wisconsin)
W70-08653

RELATIONSHIPS BETWEEN BACTERIA AND PHYTOPLANKTON,
Byelorussian State Univ., Minsk (USSR). Dept. of Invertebrate Zoology.
Yu S Potaenko, and T M Mikheeva.
Trans. from Mikrobiologiya, Vol 38, No 4, p 722-727. July-Aug 1969. Microbiology, Vol 38, No 4, p 603-607, 1969. 3 fig, 37 ref.

Descriptors: *Bacteria, *Phytoplankton, *Lakes, Algae, Microorganisms, Biomass, Diatoms, Cyanophyta, Iron, Algicides, Zooplankton, Fish.
Identifiers: Byelorussia (USSR), Polychloropinene.

Several factors may be operational simultaneously in the characteristics of the relationship between bacteria and phytoplankton. Study of bacterioplankton and phytoplankton of eight Byelorussian lakes in different years showed there were extremely diverse relationships between algae and other microorganisma: growth of algae and bacteria proceeded in parallel, maximum algal development corresponded to minimum bacterial population and vice versa, or the growth of these groups of organisms was independent. No definite relationship was observed between bacterial growth and the presence of a given toxonomic algal group. The usual cycles for individual species and algal groups were reestablished when the disrupted equilibrium among different elements of the food chains was restored a year after the fish kill. From a study of variation in bacterioplankton grown in the Narochanskii Lakes and from data in the literature of the seasonal dynamics of bacterial population in a number of other lakes, it can be concluded that the bacterioplankton distribution and population characteristic of other eutrophic lakes in the Soviet Union is restored within 1.5 years after treatment with PCP compound. (Jones-Wisconsin)
W70-08654

NEAR-SHORE WATER CHEMISTRY OF EASTERN LAKE ERIE,
State Univ. Coll., Fredonia, N.Y.
George W. Schmidt.
Lake Erie Environmental Studies, Technical Data Report No 2. 34 p, 13 fig, 2 tab, 8 ref.

Descriptors: *Lake Erie, *Water chemistry, Physical properties, Temperature, Seasonal, Dissolved oxygen, Biochemical oxygen demand, Hydrogen ion concentration, Carbon dioxide, Runoff, Hardness (Water), Alkalinity, Detergents, Lignins, Winds, Tributaries, Waves (Water), Oxidation-reduction potential, Iron, Ammonia, Silica, Suspended load, Phosphates, Coliforms, Bicarbonates, Chlorides, Sulfates, Nitrates, Copper, Trace elements, Precipitation (Atmospheric), Magnesium, Turbidity.
Identifiers: *Near-shore, *Eastern Lake Erie, Tannins, Chromates, Conductance.

A base line of physical and chemical parameters for near-shore waters of the eastern basin of Lake Erie has been established for an 18 month period from mid-July 1968 through mid-December 1969. Variations due to water temperature changes were detectable in dissolved oxygen concentration, biochemical oxygen demand, and hydrogen ion concentration. Dissolved carbon dioxide concentration was not shown to be water temperature dependent by the method employed. Hydrogen ion concentration data do indicate that solubility of carbon dioxide was probably dependent on water temperature. Effluents of individual streams were detectable in the water chemistry of the lake, whicl varied widely in chemical constituents on bot seasonal and random basis. Mixing of near-shor waters was generally dependent upon wind velocit and wave conditions. Calm periods, in which littl mixing occurred, appeared to have caused a stand ing water mass along the near-shore area. Thi might have influenced decomposing organic matte to decrease the oxidation-reduction potential lo cally. Continuous recording devices to monito water temperature, dissolved oxygen concentra tion, hydrogen ion concentration, specific con ductance, oxidation-reduction potential, wate level, and local stream discharge would be of tre mendous value in interpreting short term change in all parameters. (Jones-Wisconsin)
W70-08658

BIOLOGICAL EFFECTS ON SEDIMENT WATER NUTRIENT INTERCHANGE,
California Univ., Berkeley. Sanitary Engineerin Research Lab; and Sunn, Low, Tom, and Hara Inc., Honolulu, Hawaii.
For primary bibliographic entry see Field 05C.
W70-08944

2I. Water in Plants

CHEMICAL PROPERTIES, PHYSICAL PRO PERTIES AND PLANT GROWTH IN TWENT ARTIFICIAL WILDLIFE MARSHES,
Cornell Univ., Ithaca, N. Y. Dept. of Agronomy.
D. J. Lathwell, H. F. Mulligan, and D. R. Bouldin.
New York Fish and Game Journal, Vol 16, No 2, 158-183, July 1969. 26 p, 2 fig, 17 tab, 8 ref.

Descriptors: *Water chemistry, *Marshes, *Mars management, *Habitat improvement, *Soil-water plant relationships, Flooding, Wildlife manage ment, Soil chemistry, Marsh plants, Swamps, Wate balance, Energy budget, Nutrients.
Identifiers: Artificial Wildlife marshes.

Measurements of physical and chemical charac teristics of water and bottom soil were mad throughout each season from 1960 to 1967 on 2 artificial marshes to determine factors that in fluenced the growth of aquatic plants important a food sources for wildlife. Water depth was varie from 1 to 3 feet, and throughout the study greate plant growth was observed in the shallowe marshes. Additions of organic matter to the bottor soils resulted in increased plant growth early in th study, but in later years they had little effect. Th additions of limestone to this neutral to calcareou soil material had no effect on plant growth. Of th factors measured, to extractable iron in the sed ment increased at an increasing rate while extracta ble manganese increased only slightly over th course of the study. Total alkalinity of the wate decreased consistently throughout the first si years, but it increased during the last two years c the study. (Knapp-USGS)
W70-08595

HOW CROPS ABSORB WATER,
Duke Univ., Durham, N. C. Dept. of Botany.
Paul J. Kramer.
Connecticut Agricultural Station, New Haven, Bu letin 708, p 42-62, July 1969. 9 fig, 3 tab, 55 ref.

Descriptors: *Soil-water-plant relationships, *Roo systems, *Flow resistance, *Chemical potentia *Absorption, *Soil water movement, Sa tolerance, Aeration, Soil temperature, Transpira tion, Hydraulic conductivity, Xylem, Dehydratior Arid lands, Breeding, Turgidity, Leaves, Stomata Soil texture, Osmotic pressure, Dessicants, Cuticle
Identifiers: *Water feedback loops, *Root surfac area, *Salinity tolerance, *Water potentia *Dehydration tolerance, Active transport, Passiv transport, Suberized roots, Root hairs, Root ho mones, Guttation.

Available data indicates that crop plants use 250-500 units of water per unit of dry matter produced. Continued growth therefore depends on a balance between absorption gains and transpiration losses. Plant water absorption is directly related to water potential differences between soil and root surface or between root surface and root xylem. The physical factors affecting root water absorption are discussed and it is argued that not only are water and salts absorbed by root hairs but also by suberized roots. Roots also produce chemical substances which indirectly affect plant water balance. Soil water availability and absorption are functions of soil water potential, soil hydraulic conductivity, soil temperature, soil aeration, soil salinity and root water potential. The importance of each limiting factor is discussed particularly for semi-arid and arid zone soils. The major factors in any program of breeding for improved plant water balance mechanisms would be: (1) Improved root systems (2) Transpiration reduction (3) Increased dehydration tolerance (4) Increased salt tolerance. (Casey - Arizona)
W70-08816

ENVIRONMENTAL FACTORS AFFECTING RESISTANCE TO DESICCATION IN THE DIATOM STAURONEIS ANCEPS,
Arizona Univ., Tuscon. Dept. of Biological Sciences.
H. P. Hostetter, and R. W. Hoshaw.
American Journal of Botany, Vol 57, No 5, p 512-518, May-June 1970. 6 fig, 4 tab, 14 ref.

Descriptors: *Diatoms, *Dehydration, *Drought resistance, *Environmental effects, *Moisture stress, Drying, Drought, Algae, Aquatic algae, Arid lands, Deserts, Arizona, Particle size, Temperature, Cultures, Cytological studies, Plant physiology.
Identifiers: *Survival, *Metabolites.

Among the environmental parameters affecting the ability of Stauroneis anceps Ehr. to withstand conditions of severe water stress are culture age, type of medium, temperature, vapor pressure, and particle size of substrate. Cells grown in soil-water survived drying to equilibrium with atmospheric humidity better than cells grown in defined medium. Similarly, cells grown from older cultures survived better than those from young ones, perhaps due to accumulation by older cultures of secreted metabolites in the medium. If drying occurs in artificial substrata there is survival when particulate matter is 100 microns in diameter or larger, but no survival at less than 50 microns. Slow drying apparently enhances survival and desiccated cells withstand temperature extremes better than vegetative cells in an aqueous environment. Normal cultures could not survive 1 hr at 60 C, but dry cells survived more than 9 days at that temperature and longer than 8 hr at 80 C. Vapor pressure deficits of 11.9 mm Hg or higher facilitated cell survival under storage. Since algal cells are able to withstand long periods of dehydration and this desiccated state enables them to survive extremely high temperatures, it would appear that survival of algae in ephemeral desert pools often involves dehydrated cells. (Carr - Arizona)
W70-08817

GROWTH, YIELD, AND YIELD COMPONENTS OF SAFFLOWER AS AFFECTED BY IRRIGATION REGIMES,
Arizona Agricultural Experiment Station, Tucson.
Leonard J. Erie, and Orrin F. French.
Agronomy Journal, Vol 61, No 1, p 111-113, January-February 1969. 1 fig, 5 tab, 1 ref.

Descriptors: *Arizona, *Oilseed crops, *Crop production, *Plant growth, *Water requirements, Soil water, Irrigation, Irrigation effects, Irrigation practices, Crop response, Arid lands, Soil moisture, Moisture availability, Moisture stress, Consumptive use, Soil-water-plant relationships, Flowering, Seeds.
Identifiers: *Safflower, *Irrigated agriculture, *Yield components.

Safflower (Carthamus tinctorius L.) was grown in Arizona in order to study the effect of irrigation regime on plant growth and seed yield. Fall-planted Frio safflower was subjected to 8 different irrigation treatments. Four treatments were irrigated when 60% of the available moisture in the upper 120 cm of soil was depleted; four other treatments were irrigated at the 72% level. Five irrigation cutoff dates were used, varying from 3 weeks before first flowering until harvest. Individual plots received from 3 to 9 irrigations, depending on the combination of soil moisture depletion treatments and varying cutoff dates. The study found that with each increment of irrigation water there was a tendency for seed yield, weight per seed, seeds per head, and oil content to increase, while percentage of hollow seed decreased. It would appear that 7 irrigations given until the last flowers opened was the preferable irrigation regime. The treatment yielded 3,961 kg/ha of seed and consumed 107 cm of water. This resulted in the greatest seed yield per centimeter of water used by the plant. When last irrigation occurred at the time of first flowering, yield declined 800 kg/ha. Last irrigation 10 days prior to flowering caused a reduction in yield of almost one-half. (Carr - Arizona)
W70-08818

WATER UPTAKE BY ORCHARDGRASS AND EVAPORATION FROM BARE SOIL IN THE PRESENCE OF SHALLOW WATER TABLES,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 02D.
W70-08820

EFFECT OF THE SOL-GEL TRANSFORMATION IN CLAY-WATER SYSTEMS ON BIOLOGICAL ACTIVITY: I. SEED GERMINATION AND BACTERIAL THERMOGENESIS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 02K.
W70-08952

VEGETATION MANAGEMENT FOR WATER YIELD,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 03B.
W70-08991

2J. Erosion and Sedimentation

PRELIMINARY STUDY OF TRANSVERSE BARS,
Florida State Univ., Tallahassee. Geophysical Fluid Dynamics Inst.
For primary bibliographic entry see Field 02L.
W70-08590

BRYOZOAN CARBONATE SAND CONTINUOUS ALONG SOUTHERN AUSTRALIA,
Sydney Univ. (Australia). Dept. of Geology and Geophysics; South Carolina Univ., Columbia. Dept. of Geology; and New South Wales Univ., Kensington (Australia). Dept. of Zoology.
Robin E. Wass, John R. Conolly, and R. J. Macintyre.
Marine Geology, Vol 9, No 1, p 63-73, June 1970. 11 p, 6 fig, 3 tab, 13 ref.

Descriptors: *Sands, *Calcium carbonate, *Bottom sediments, *Benthic fauna, Marine animals, Sands, Sedimentary structures, Sampling, Data collections.
Identifiers: *Australia, Bryozoa.

Modern and reworked Pleistocene and Tertiary bryozoan calcareous sand extends over the 20-150 miles wide and 2,500 miles long continental shelf of southern Australia from north of Perth on the west coast, eastwards to east Bass Strait. Bottom photography and dredge samples reveal that living Bryozoa thrive most abundantly at depths of 50-120 fathoms and that catenicelliform Zoaria occur in fine grained sand in quite water whereas lunulitiform Zoaria live in loose, moving, rippled sands; reteporiform Zoaria are common in water with mild current action. Adeoniform and vinculariiform Zoaria commonly occur at depths greater than 100 fathoms. (Knapp-USGS)
W70-08591

SAND RIBBONS OF EUROPEAN TIDAL SEAS,
National Inst. of Oceanography, Wormley (England).
For primary bibliographic entry see Field 02L.
W70-08592

SEDIMENTS OFF THE WEST COAST OF BARBADOS: DIVERSITY OF ORIGINS,
McGill Univ., Montreal (Quebec).
Ian G Macintyre.
Marine Geology, Vol 9, No 1, p 5-23, June 1970. 19 p, 8 fig, 34 ref.

Descriptors: *Bottom sediments, *Oceans, *Continental shelf, Marine geology, Carbonates, Sands, Carbonate rocks, Sedimentation, Provenance, Deposition (Sediments), Diagenesis.
Identifiers: *Barbados.

A multiplicity of sources is evident in marine sediments off the west coast of Barbados, W.I., where sediments and morphology of the sea floor studied to a depth of 1,300 ft. A high percentage of the carbonate material was not formed in the present environment of deposition. Shoreward of a depth of 70 ft., sediments of the insular shelf facies are composed mainly of modern skeletal material along with detrital deposits. Between depths of 70 and 400 ft. (an area that includes two submerged reefs) sediments of the upper slope facies contain a complicated mixture of relict residual, modern organic and volcanic material. Seaward of a depth of about 400 ft. in the slope facies, sediments are composed mainly of residual material derived from submarine outcropping beds, but include some volcanic and modern organic material. The pyroclastic material in the marine sediments was derived from La Soufriere on the island of St. Vincent, which is 100 miles west and leeward of Barbados. Then noncarbonate fraction of the insular shelf sands is predominantly detrital quartz. Grey discoloration in carbonate grains, which is caused primarily by the presence of diagenetic pyrite, occurs in those grains that were transported into stagnant, ponded river mouths that are common along the west coast of Barbados. (Knapp-USGS)
W70-08593

INSTRUMENTATION AND TECHNIQUES IN SEDIMENT SURVEYING,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
W. Stichling.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 81-139, Vol 1, 1969. 59 p, 42 fig, 26 ref.

Descriptors: *Instrumentation, *Sediment load, *Sampling, Data processing, On-site tests, Laboratory tests, Sediment discharge, Suspended load, Bed load, Surveys, Data collections.
Identifiers: Sediment instrumentation, Canada.

Satisfactory instruments and techniques for measuring suspended sediment discharge have been developed over the last 25 years and the use of radioisotope and other monitoring instruments promises to increase the effectiveness of existing methods. In the case of bed-load discharge measurement, however, equipment and techniques are still far from satisfactory. There is hope that research into the use of tracers or other techniques may lead to a breakthrough. The grain-size distribution in the bed material must be known and in-

formation on other hydraulic parameters must be available. Satisfactory sampling of bed material is possible using existing equipment. The field and laboratory equipment and techniques used in Canada for measuring suspended sediment discharge and bed-load discharge and for sampling bed material are described. (Knapp-USGS)
W70-08626

GRAIN ORIENTATION IN DETERMINATION OF PALEOCCURRENTS AND SANDSTONE TRENDS,
Oklahoma State Univ., Stillwater. Dept. of Geology.
John W. Shelton, and Douglas E. Mack.
American Association of Petroleum Geologists Bulletin, Vol 54, No 7, p 1108-1119, July 1970. 10 fig, 1 tab, 24 ref.

Descriptors: *Sedimentary rocks, *Currents (Water), *Deposition (Sediments), *Sedimentary structures, Instrumentation, Laboratory tests, Borehole geophysics, Sedimentology, Sandstones, Sands.
Identifiers: Paleoccurrent analysis, Particle orientation.

Measurement of grain orientation in relatively large samples by means of a dielectric anisotropy device is both rapid and reliable. It corresponds accurately to other paleoccurrent indicators, such as parting lineation, rib-and-furrow structures, sole marks, and cross-bedding. Because grains are imbricated upcurrent, current direction can be inferred accurately from analysis of grain orientation in the vertical plane paralleling the horizontal grain fabric. Dielectric anisotropy measurements of partly impregnated Cimarron River sand depict very well recent local current directions of the river. Because the horizontal component of grain orientation in horizontally bedded or cross-bedded sands statistically corresponds to current trend, remote measurement of grain orientation in a borehole could make possible the determination of sandstone trend from a single well. Adaptation of the dipmeter log offers an available tool for such a technique. (Knapp-USGS)
W70-08933

GEOLOGICAL SIGNIFICANCE OF COCCOLITHS IN FINE-GRAINED CARBONATE BANDS OF POSTGLACIAL BLACK SEA SEDIMENTS,
Geological Survey, La Jolla, Calif. Marine Geology Lab; Cities Service Oil Co., Okla; and Woods Hole Oceanographic Institution, Mass.
David Bukry, Stanley A. Kling, M. K. Horn, and Frank T. Manheim.
Nature, Vol 226, No 5241, p 156-158, April 11, 1970. 2 fig, 1 tab, 19 ref.

Descriptors: *Bottom sediments, *Carbonates, Limestone, Mud, Sediments, Sedimentary rocks.
Identifiers: *Black Sea, *Coccoliths.

Samples containing fine carbonate from cores obtained during the cruise of Atlantis II (Woods Hole Oceanographic Institute) to the Black Sea in April and May 1969 were examined by scanning electron micrographs and light microscopy. Holocene coccoliths are the overwhelmingly dominant constituents in the light bands, whereas Cretaceous and Eocene coccoliths are important components of the carbonate in the darker matrix. (Knapp-USGS)
W70-08934

2K. Chemical Processes

WATERS FOR WATERFLOODING SAN JOAQUIN VALLEY, CALIF, PETROLEUM RESERVOIRS,
Bureau of Mines, San Francisco, Calif. Petroleum Research Office.
G. L. Gates, and W. H. Caraway.
U S Bureau of Mines Report of Investigations 7401, June 1970. 18 p, 4 fig, 7 tab, 25 ref.

Descriptors: *Water quality, *Water chemistry, *Water sources, *California, *Secondary recovery (Oil), Flooding, Injection, Oil fields, Oil reservoirs, Sea water, Fresh water, Brines, Irrigation water, Saline water, Permeability.
Identifiers: San Joaquin Valley (Calif).

Five possible sources of water for waterflooding of petroleum reservoirs in the arid San Joaquin Valley of California were considered. Three of them (water produced with petroleum, water from a shallow saline aquifer, and waste irrigation water) were analyzed chemically; laboratory information for sea water was developed in a previous study. A series of laboratory tests made on the fifth source (fresh water) determined the solubility of calcium sulfate dihydrate in water. Laboratory analyses included: chemical analyses of water produced with petroleum and waste irrigation water; solubility of calcium sulfate dihydrate in water and brines; the effect of excess sulfate on the solubility of calcium sulfate in brines; the presence of sulfate-reducing bacteria; and the permeability of cores from a petroleum reservoir. Most of the waters and mixtures of waters are compatible with petroleum reservoir waters and are generally suitable for injection. Formation damage due to clay swelling will not be serious. The waters most likely to be available for injection are water produced with petroleum, water from shallow saline aquifers, and waste irrigation water. (Knapp-USGS)
W70-08587

DETERMINING THE DISSOLVED OXYGEN IN SMALL QUANTITIES OF WATER,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05A.
W70-08594

CHEMICAL PROPERTIES, PHYSICAL PROPERTIES AND PLANT GROWTH IN TWENTY ARTIFICIAL WILDLIFE MARSHES,
Cornell Univ., Ithaca, N. Y. Dept. of Agronomy.
For primary bibliographic entry see Field 02I.
W70-08595

INSTRUMENTATION IN WATER QUALITY MONITORING AND SAMPLING,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05A.
W70-08616

A WATER QUALITY MODEL OF CHLORIDES IN GREAT LAKES,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
Donald J. O'Connor, and John A. Mueller.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA4, Paper 7470, p 955-975, August 1970. 14 fig, 6 tab, 23 ref, append.

Descriptors: *Water quality, *Great Lakes, *Chlorides, *Salt balance, *Mathematical models, Water balance, Streamflow, Hydrologic budget.
Identifiers: Water quality models.

The increase in the concentration of conservative substances in the Great Lakes is described by a simple time variable equation. The concentration of chlorides is related to the fresh water flow, the volumes of the lakes and the various sources--municipal, industrial, natural background and road deicing. The increase in concentration since 1900 is presented and projections are made of anticipated concentrations based on various assumptions of control. (Knapp-USGS)
W70-08931

GROUNDWATER FLOW SYSTEMS AND AC CUMULATION OF EVAPORITE MINERALS,
Idaho Univ., Moscow. Coll. of Mines.
For primary bibliographic entry see Field 02F.
W70-08935

CONTENT OF TRACE ELEMENTS I PRECIPITATION,
Main Geophysical Observatory, Liningrad (USSR and Institute of Experimental Meteorology, Ob ninsk (USSR).
For primary bibliographic entry see Field 02B.
W70-08940

MODEL FOR CAPTURE OF RADIOACTIVIT BY PRECIPITATION,
Institute of Experimental Meteorology, Obnins (USSR).
For primary bibliographic entry see Field 02B.
W70-08941

STRONTIUM 90 FALLOUT DISTRIBUTION A MIDDLE LATITUDES OF THE NORTHER AND SOUTHERN HEMISPHERES AND IT RELATION TO PRECIPITATION,
Institute of Experimental Meteorology, Obnins (USSR). Hydrometeorological Service.
For primary bibliographic entry see Field 02B.
W70-08942

EFFECT OF THE SOL-GEL TRANSFORMA TION IN CLAY-WATER SYSTEMS O BIOLOGICAL ACTIVITY: I. SEED GERMINA TION AND BACTERIAL THERMOGENESIS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
K. W. Lee, B. G. Davey, and P. F. Low.
Soil Science Society of America Proceedings, Vo 34, No 1, p 45-49, January-February 1970. 4 fig, tab, 28 ref.

Descriptors: *Clays, *Gels, *Soil-water-plant rel tionships, Ion transport, Ion exchange, Viscosit Water chemistry.
Identifiers: Clay-water systems.

Gels containing 4, 6, and 8% Na or Na/Al clay (Na clay with hydrous aluminum oxide impurity) wer extruded through a 20-gage hypodermic need into petri dishes. Half of the petri dishes wer tapped on the laboratory bench to disturb the ge within them. Lettuce seeds were planted on all th samples; the lettuce seeds germinated faster on th disturbed gels. In a second experiment, gels co taining 4% Na or Na/Al clay were mixed wit nutrient medium and inoculated with the bacter um Streptococcus faecalis. Then the inoculate gels were extruded through a 20-gage hypoderm needle into pairs of calorimetric cells. Before i serting the cells into the Calvert calorimeter, or member of each pair was tapped to disturb the ge Bacterial heat production was greater in th disturbed gels than in the undisturbed ones. In third experiment, Na or Na/Al clay sols and ge were mixed with nutrient medium, inoculated, an extruded into pairs of calorimetric cells, as befor This time, neither cell was tapped to disturb its co tents, but the concentration of clay in one was di ferent from that in the other. There was more he production in the cells in which the clay concentra tion was lower and the clay-water system was a so Biological activity was usually smaller in a clay g than in a clay sol. (Knapp-USGS)
W70-08952

THE APPLICATION OF PHASE SELECTIV ALTERNATING CURRENT POLAROGRAPH TO THE ANALYSIS OF HEAVY METALS I WATER,
Georgia Inst. of Tech., Atlanta. Environment Resources Center.
For primary bibliographic entry see Field 05A.
W70-08986

2L. Estuaries

PRELIMINARY STUDY OF TRANSVERSE BARS,
Florida State Univ., Tallahassee. Geophysical Fluid Dynamics Inst.
A. W. Niedoroda, and W. F. Tanner.
Marine Geology, Vol 9, No 1, p 41-62, June 1970. 22 p, 7 fig, 28 ref. ONR Contract N-00014-68-A-0159.

Descriptors: *Sand bars, *Sedimentary structures, *Beaches, *Sand waves, Sediment transport, Deposition (Sediments), Scour, Erosion, Currents (Water), Waves (Water).
Identifiers: Transverse bars, Beach structure.

Transverse bars (finger bars) are extremely common along sandy beaches in low-to-moderate wave energy regimes. They are typically oriented normal or nearly normal to the beach toe. Each transverse bar acts as a focusing lens for advancing waves, controlling wave refraction in such a way that: (1) the transverse bar is maintained; (2) sediment is transported along the long axis of the bar; and (3) a subtle but nevertheless effective circulation pattern is established, whereby water is transported seaward from the surf, without rip currents. In areas where transverse bars are numerous and well developed, the onshore or offshore transport of sand along the bar axes may be more important than littoral drift. Preliminary data indicate that current strength is a direct function of the depth of water over the bars and an exponential function of the initial wave height. (Knapp-USGS)
W70-08590

BRYOZOAN CARBONATE SAND CONTINUOUS ALONG SOUTHERN AUSTRALIA,
Sydney Univ. (Australia). Dept. of Geology and Geophysics; South Carolina Univ., Columbia. Dept. of Geology; and New South Wales Univ., Kensington (Australia). Dept. of Zoology.
For primary bibliographic entry see Field 02J.
W70-08591

SAND RIBBONS OF EUROPEAN TIDAL SEAS,
National Inst. of Oceanography, Wormley (England).
Neil H. Kenyon.
Marine Geology, Vol 9, No 1, p 25-39, June 1970. 15 p, 12 fig, 22 ref.

Descriptors: *Bottom sediments, *Tides, *Currents (Water), *Continental shelf, *Sands, *Tidal waters, Oceans, Sedimentary structures, Sand bars, Sand waves, Sediments, Sediment transport, Sedimentation.
Identifiers: Sand ribbons, Europe.

Ribbons of sediment, up to 15 km long and up to 200 m wide, extend parallel to the bed load transport paths of the tidal currents. The ribbons have been found by the side-scan Asdic method in most of those areas of the sea floor around the British Isles where tidal currents have maximum near surface velocities of 2 knots or more. The four types of ribbons, distinguished by their form, are related to tidal current velocity and supply of sand. Underwater photographs taken in a sand ribbon zone reveal bodies of shelly sand usually too thin to mask completely the underlying coarse material, but sometimes thick enough for the formation of small-scale bedforms including ripple marks and sand shadows. There is a variety of underlying coarse material and locally there are accumulations between the sand ribbons of the more durable shells that may be more readily preserved in ribbon form than the sand itself. (Knapp-USGS)
W70-08592

SEDIMENTS OFF THE WEST COAST OF BARBADOS: DIVERSITY OF ORIGINS,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 02J.
W70-08593

STUDIES OF THE MARINE MICROORGANISMS UTILIZING INORGANIC NITROGEN COMPOUNDS--IV. ON THE LIBERATION RATES OF INORGANIC NITROGEN COMPOUNDS FROM BOTTOM MUDS TO SEA WATER (In Japanese),
Kyoto Univ. (Japan). Dept. of Fisheries.
Yoichi Yoshida, and Masao Kimata.
English summary. Bulletin of the Japanese Society of Scientific Fisheries, Vol 35, No 3, p 303-306, 1969. 3 fig, 1 tab, 7 ref.

Descriptors: *Mud, *Sea water, *Nitrogen, Inorganic compounds, Ammonia, Nitrites, On site tests, Cores, Laboratory tests, Aphotic zone.
Identifiers: *Sea bottom muds, Inorganic nitrogen, Nitrate nitrogen, Maizuru Bay (Japan), Disphotic zone, Euphotic zone.

Release of ammonia, nitrite, and nitrate nitrogen from bottom muds to sea water was studied by direct sampling and by simulation of conditions in a small 60 centimeter-wide equarium. Analyses of water above the bottom and of mud cores, conducted from January till September 1967, showed the liberation of elemental nitrogen from 0.1 to 2.0 microgram per 100 square centimeter/hour. The largest part of the released nitrogen was in ammonia form. The trials under laboratory conditions yielded similar results, even though the bottom mud in aquarium contained predominantly nitrate nitrogen. (Wilde-Wisconsin)
W70-08661

TIME AND EXTENT OF A FLOW REVERSAL IN THE LOWER COLUMBIA RIVER,
Bureau of Commercial Fisheries, Seattle, Wash.
Shirley M. Clark, and George R. Snyder.
Limnology and Oceanography, Vol 14, No 6, November 1969, p 960-965. 3 fig, 2 tab, 3 ref.

Descriptors: *Cooling water, *Tidal effects, *Stagnant water, *Thermal powerplants, Heated water, Water temperature, Low flow, Tracers, Columbia River, Thermal pollution.
Identifiers: *Flow reversal.

Tracer study showed that because of the effect of tides, an extensive upstream movement of water can occur near Prescott during low flow stages of the Columbia River. Under these conditions, thermal electric plants would use the same water more than once for cooling their condensers and repeatedly subject fixed masses of water to their heated effluents. The reversal of the river would cause a periodic concentration of rejected heat from the thermal electric plant in sections of the river downstream producing an increase in the temperature of isolated volumes of water that is above the average rise for the river. Temperature rise was estimated. The study points out that this problem should be studied intensively to evaluate the biological risk before final designs of the proposed installations of power plants are accepted. (Hsieh-Vanderbilt)
W70-08831

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF NEW REVERSE OSMOSIS MEMBRANES FOR DESALINATION,
North Star Research and Development Inst., Minneapolis, Minn.
L. T. Rozelle, J. E. Cadotte, and D. J. McClure.
For sale by Superintendent of documents, US Government Printing Office, Wash, DC 20402, Price $1.25. US Office of Saline Water Research and Development Progress Report No 531, June 1970. 124 p, 21 fig, 24 tab, 26 ref, 3 append. Contract No 14-01-0001-1696 OSW.

Descriptors: *Membranes, *Desalination, *Reverse osmosis, *Cellulose, *Plastics, Desalination processes, Permselective membranes, Semipermeable membranes, Research and development, Laboratory tests, Thin films, Permeability.
Identifiers: Ultrathin membranes.

A process was developed for forming ultrathin membranes by casting a cellulose acetate solution on a water surface. These membranes can provide greater than 99 percent salt rejection, and they could be formed as thin as 500 angstroms. A promising support film of polysulfone was also developed. The feasibility of casting ultrathin cellulose acetate membranes and the polysulfone support films in tubes was proved and the casting variables defined. These ultrathin membranes, along with the polysulfone support films, were successfully applied to commercial tubes and tested. Several successive membrane removals and replacements were carried out successfully in the commercial tubes without manual manipulation of the module. A number of new ultrathin membranes from mixed esters and ethers of cellulose acetate were found to exhibit water flux and flux decline properties superior to cellulose acetate. (Knapp-USGS)
W70-08932

SMALL DESALINATION UNIT TO TEST SCALE-REDUCTION ADDITIVES,
Rhode Island Univ., Kingston. Dept. of Chemical Engineering.
Niels Madsen.
Available from the Clearinghouse as PB-193 411, $3.00 in paper copy, $0.65 in microfiche. Completion Report, 1969. 19 p. OWRR Project A-020-RI (1).

Descriptors: *Desalination, *Scaling, *Flash distillation, *Heat transfer, *Model studies, *Testing, *Additives, *Scale deposition, *Scale prevention, *Multiple flash distillation, *Simulation.

A mathematical model of the reduction in the heat-transfer rate with elapsed time, when a scaling fluid is heated, is given. Considerations that were made during the design of a semi-portable heat transfer apparatus for simulating the heating of sea water in a multi-stage flash evaporation unit are presented. The results of several preliminary calibrations and tests, including a 12 hr. run with the maintenance of flow rate, outlet temperature, outlet pressure, and temperature driving force are presented. The testing was done with non-scaling water only. (Madsen-Rhode Island)
W70-08985

MODIFYING THE WATER BALANCE BY DESALINATION,
Geological Survey, Washington, D.C.; and Office of Saline Water, Washington, D.C.
Francis A. Kohout, and Milton S. Sachs.
In: Proceeding of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 214-222, 1969. 4 fig, 19 ref.

Descriptors: *Desalination, *Water costs, *Water balance, Water utilization, Water supply, Surveys, Reviews, Economics, Municipal water, Water resources development, Saline water, Groundwater, Saline water systems.
Identifiers: Desalination costs.

Desalination costs have decreased from about $5/1000 gallons in the early 1950's to about $1/1000 gallons for sea-water distillation in the late 1960's. These costs do not include delivery to the consumer. Because of the high cost, desalination has been considered as an alternate water-supply scheme where fresh-water deficiencies are great. However, two of the largest desalting plants in the United States are located in Florida, where annual

rainfall averages 50 to 60 inches per year. The seeming contradiction is related to subjective factors not always considered in the balance of conventional vs. desalted water costs. For example, public health departments and consumers in some areas are demanding better water than Nature can provide at an economical distance from the point of use. Desalination of previously unused, onsite saline water creates completely controllable, potable water which is free from economic, legal and political entanglements. Desalination is a factor that can be expected to substantially affect the water balance of North America. (See also W70-08597)
W70-08996

3B. Water Yield Improvement

LAND MANAGEMENT IN MUNICIPAL WATERSHEDS,
For primary bibliographic entry see Field 06E.
W70-08797

STATUS OF PILOT WATERSHED STUDIES IN ARIZONA,
Forest Service (USDA), Flagstaff, Ariz.
Harry E. Brown.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR 1, Paper 7129, p 11-23, March 1970. 11 fig, 30 ref.

Descriptors: *Small watersheds, *Demonstration watersheds, *Water yield improvement, *Rainfall-runoff relationships, *Arizona, Soil-water-plant relationships, Vegetation effects, Clear-cutting, Evapotranspiration control.
Identifiers: Experimental watersheds (Arizona).

Critical water shortage in Arizona have led to intensive investigations of methods for increasing streamflow from the State's watersheds. These investigations include research studies of hydrologic processes and behavior, pilot tests of promising treatments, economic studies, and surveys of potentially treatable areas. Results are reported from pilot tests in chaparral, juniper, ponderosa pine, and mixed conifer vegetation types. To date, streamflow responses following watershed treatments have varied from zero to as much as 9 inches per year, depending on the nature of the treatment, type of vegetation, and climate. These results and others forthcoming will play an important role in future multiple use management of forest lands in Arizona. (Knapp-USGS)
W70-08946

NEW WATER FOR NORTHERN PLAINS,
South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
Richard A. Schleusener.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR1, Paper 7145, p 53-60, March 1970. 1 fig, 1 tab, 6 ref. Contract No 14-06-D-5979 (Bu Rec), Contract No N60530-67-C-1289 (Navy).

Descriptors: *Cloud seeding, *Water yield improvement, *Weather modification, Projects, Artificial precipitation, Nucleation, Rainfall, On-site tests, Research and development, Analytical techniques, On-site investigations, Resource development.
Identifiers: Northern plains.

Current research in cloud seeding follows a plan to progress from experimental projects on individual clouds (or areas less than 1,000 sq miles) to pilot projects involving several thousand square miles to operational projects over areas of thousands of square miles. Research to date has shown that individual clouds exist that can be made to produce additional precipitation by seeding, and a beginning has been made on defining the meteorological conditions for which cloud seeding can produce additional usable precipitation. Results of cloud seeding for hail suppression are mixed. Pilot projects extending over several thousand square miles are now needed to determine whether the effects found on experimental projects can be extended to larger areas. There is a need to leave a limited number of cases (randomly selected) unseeded as controls to monitor the effects of the weather modification treatment. It is proposed that the fraction left unseeded change from 50% for experimental projects to 25% for pilot projects to 10% for operational projects. (Knapp-USGS)
W70-08950

RESPONSIBILITY IN WEATHER MODIFICATION OPERATION,
Fresno State Coll. Foundation, Calif. Atmospheric Water Resources Research; and South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
Merlin C. Williams, and Richard A. Schleusener.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR1, Paper 7171, p 61-66, March 1970. 6 ref.

Descriptors: *Weather modification, *Water yield improvement, *Water law, *Regulation, Legal aspects, Management, Permits, Standards.
Identifiers: Weather-management regulation.

Recent experience has shown that weather modification can be used to produce beneficial changes in atmospheric processes. The possibility of using this new technology as a watershed management tool requires consideration of the conditions under which the tool is used and the responsibilities required for its use. Evidence resulting from a number of projects indicates that both benefit and disbenefits may result from treatment of extremely variable weather systems. The need for responsible operations can be met by assuring that the individuals involved in these activities have the requisite experience, education and ethical standards. A means for meeting this need is proposed through the identification of individuals with the necessary qualifications on a basis similar to engineering registration. (Knapp-USGS)
W70-08951

PHYSIOGRAPHY-LAND USE INTERACTIONS IN WATERSHED MANAGEMENT,
British Columbia Univ., Vancouver. Dept. of Forestry.
For primary bibliographic entry see Field 05B.
W70-08989

VEGETATION MANAGEMENT FOR WATER YIELD,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Marvin D. Hoover.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 191-195, 1969. 8 ref.

Descriptors: *Water yield improvement, *Forest management, *Watershed management, Water yield, Economics, Clear-cutting, Lumbering, Planting management, Vegetation effects, Rainfall-runoff relationships.
Identifiers: Vegetation management.

Large-scale management of forest lands for water may be possible because they are held in large blocks and much is publicly owned. Yield increases tend to be greater during normally high runoff periods and in wet years. Economic value of such yield increases depends on water uses in the basin and on available storage. Large areas in the West approach ideal vegetation patterns and are now yielding near their potential. Where tree products are merchantable, water increase can be a valuable by-product of timber harvesting. However, where timber is of low wood value or high efficiency in water production is desired, financing for water improvement must be found. Artificial augmentatio of precipitation appears to offer promise for moun tain areas which are often forest covered. Success ful weather modification would increase the eff ciency of vegetation management practices. (Se also W70-08597)
W70-08991

CLOUD SEEDING AND RAIN MAKING,
Alberta Univ., Edmonton. Dept. of Meteorology.
Richmond W. Longley.
In: Proceedings of Symposium on Water Balance i North America, June 23-26, 1969, Banff, Alberta Canada, American Water Resources Associatio Urbana, Illinois, p 196-200, 1969. 10 ref.

Descriptors: *Cloud seeding, *Water yield im provement, *Reviews, Economics, Testing, Ap praisals, Evaluation, Projects.
Identifiers: Cloud seeding evaluation.

The present status of cloud seeding to produce rai is reviewed. Some trials have indicated a 20 pe cent increase of rain. Other trials are inconclusive As yet there is no clear evidence on the 'side-e fects' of cloud seeding. Further experiments mu be made to insure that cloud seeding in one are does not adversely affect people in another are Also it is necessary to examine further the reason why seeding is effective in some situations and ine fective in other situations. (See also W70-08597)
W70-08992

SOME RECENT RESEARCH IN EVAPORA TION SUPPRESSION,
Geological Survey, Denver, Colo.
G. Earl Harbeck, Jr.
In: Proceedings of Symposium on Water Balance i North America, June 23-26, 1969, Banff, Alberta Canada, American Water Resources Associatio Urbana, Illinois, p 201-213, 1969. 30 ref.

Descriptors: *Evaporation control, *Monomolecu lar films, *Reviews, Research and developmen Seepage, Reservoir evaporation, Water conserva tion, Reservoir leakage.
Identifiers: Geological Survey, Bureau of Reclam tion.

Since 1960 considerable research has been co ducted in the use of monomolecular films to su press evaporation. The studies of the U.S. Geolog cal Survey and the U. S. Bureau of Reclamation a reviewed. The Bureau of Reclamation als financed many other research projects in this fie undertaken by universities in the Rocky Mounta region. Much of the research was on methods applying and maintaining a film; the most succes ful techniques were film application using powde in emulsions, or by spraying molten materia Evaporation savings for the larger reservoirs we mostly about 20 percent or less. An unexpecte and unwelcome finding was that under some ci cumstances, seepage losses from small stock pon may be increased by the application of monolayer. (See also W70-08597)
W70-08993

POTENTIAL EFFECTS OF SPRINKLE AGRICULTURE ON THE NORTH AMERICA WATER BALANCE,
California Univ., Davis. Dept. of Agricultur Economics.
For primary bibliographic entry see Field 02A.
W70-08995

3C. Use of Water of Impaired Quality

WASTE WATER FOR GOLF COURSE IRRIG TION,
California State Water Resources Control Boar Goleta.
For primary bibliographic entry see Field 05D.
W70-08962

3E. Conservation in Industry

WATER FOR INDUSTRIAL DEVELOPMENT IN CLARKE, JASPER, LAUDERDALE, NEWTON, SCOTT, AND SMITH COUNTIES,
Geological Survey, Jackson, Miss., Water Resources Div.
E. H. Boswell, F. H. Thomson, and D. E. Shattles.
U S Geological Survey Open-file (duplicated) Report, 1970. 62 p, 32 fig, 9 tab, 18 ref.

Descriptors: *Water resources, *Industrial water, *Mississippi, Groundwater, Streamflow, Water quality, Hydrogeology, Data collections, Hydrologic data, Water resources development, Aquifers, Water wells.
Identifiers: Clark County, Jasper County, Lauderdale County, Newton County, Scott County, Smith County.

Detailed information is presented on the availability, chemical quality, and physical characteristics of groundwater and surface water of this six-county area in east-central Mississippi. Designed as a guide for planning and developing industrial water supplies, the report contains 32 illustrations and 9 data tables. Illustrations include 14 maps, 6 geohydrologic sections, 4 flood profiles, and several graphs showing duration of low streamflow, relation of dissolved solids to discharge and time-drawdown relations of aquifers. In 85% of the area, at least one aquifer contains water suitable for general use with little or no treatment; the water is a soft sodium bicarbonate type usually with dissolved-solids content below that recommended for most industrial uses. Wells designed for high production can yield more than 15 mgd at many places. The fresh-water section averages 1,500 ft thick and attains about 3,500 ft in Smith County. In 80% of the area, low-flow yields are less than 0.05 cfs per sq mi. Average low-flow discharge from the area is 65 mgd, mostly by the Chickasawhay and Leaf Rivers; the streamflow is of good quality. Potential is large for development of surface supplies from storage reservoirs. (Lang-USGS)
W70-08589

3F. Conservation in Agriculture

2,4-D CONTAMINATION AND PERSISTENCE IN IRRIGATION WATER,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 05B.
W70-08681

SPRINKLERS AND VEGETABLE CROP MECHANIZATION IN DESERT AREAS,
California Univ., Riverside; and California Univ., Indio. Agricultural Extention Service.
Hunter Johnson, Jr., Albert W. Marsh, and G. Neil McRae.
Preprint. PCR-69-131, 1969 Annual Convention, Pacific Coast Region, American Society of Agricultural Engineers, Phoenix, Arizona, Mar 1969. 13 p, 1 fig, 7 tab, 8 ref.

Descriptors: *Sprinkler irrigation, *Vegetable crops, *Deserts, Crops, *Arid lands, *Vegetables, *Furrow irrigation, Planting management, Plant growth, Agriculture, Irrigation, Southwest U.S., Farm management, Saline soils, Mechanization, Seeding, Crop production, Crop response, Salinity, California, Lettuce.
Identifiers: *Comparative studies, *Crop yield, Night, Precision Planting, High temperature, Coachella Valley, Calif.

Field studies were conducted on arid mechanized farms in California to evaluate the use of sprinkler and furrow irrigation on plantings of lettuce and cabbage. The studies provided substantial evidence that major improvement in germination and emergence can be expected with sprinkler irrigation when compared with the standard practice of furrow irrigation. This response can be attributed to seed-zone salt control, but additional benefits might be expected from improved soil aeration. During high-temperature periods, growers might expect greater response to sprinkling if irrigation begins at night. If better germination can be assured with sprinklers, precision planting on saline soils will become practical. Because precision planting is the first important step in mechanized culture of vegetable crops, sprinklers will be an indispensable tool in mechanization--particularly in desert areas. (USBR)
W70-08688

WATER IN THE DESERTS,
Office of Water For Peace, Washington, D.C.
For primary bibliographic entry see Field 06B.
W70-08689

GROWTH, YIELD, AND YIELD COMPONENTS OF SAFFLOWER AS AFFECTED BY IRRIGATION REGIMES,
Arizona Agricultural Experiment Station, Tucson.
For primary bibliographic entry see Field 02I.
W70-08818

SCHEDULING IRRIGATIONS USING CLIMATE-CROP-SOIL DATA,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center; Bureau of Reclamation, Denver, Colo.; and Salt River Valley Water Users' Association, Phoenix, Ariz.
Marvin E. Jensen, David C. N. Robb, and C. Eugene Franzoy.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR1, Paper 7131, p 25-38, March 1970. 1 fig, 3 tab, 30 ref, append.

Descriptors: *Irrigation efficiency, *Irrigation engineering, *Irrigation practices, *Irrigation design, *Timing, Irrigation systems, Digital computers, Water management (Applied), Water utilization, Soil-water-plant relationships, Water distribution (Applied), Evapotranspiration.
Identifiers: Irrigation scheduling.

The most important factor affecting irrigation efficiencies and crop yields is scheduling irrigations in time and amount. Overirrigation may result in waterlogged soils, a condition which reduces yields and generally results in increased costs for water, fertilizer, and drainage. Water use is at a minimum when the amount of water applied is just equal to the consumptive use and the leaching requirement. To achieve higher irrigation efficiencies, present irrigation scheduling practices must be improved. Irrigation scheduling using climate-crop-soil data, computers to facilitate the tedious computations, and field observations by experienced personnel is a service that appears to be very attractive to the modern irrigation farm manager. This service has the potential of increasing the management skills of the farmer and his net return at a reasonable cost. It supplements the art of irrigation or experienced judgement with the results of recent advances in irrigation science. (Knapp-USGS)
W70-08947

SURFACE IRRIGATION USING KINEMATIC-WAVE METHOD,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 06A.
W70-08948

SUBSURFACE IRRIGATION EASILY AUTOMATED,
California Univ., Riverside. Agricultural Research Service.
Sterling Davis, and Sheldon D. Nelson.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR1, Paper 7135, p 47-51, March 1970. 4 fig, 9 ref.

Descriptors: *Automation, *Irrigation design, *Subsurface irrigation, Irrigation engineering, Pipes, Automatic control, Mechanical control, Distribution systems.
Identifiers: Automated irrigation.

Subsurface irrigation applies water directly into the root zone of the crop and may easily be automated. Two subsurface irrigation systems are described: an automatic float-operated device to supply water needed to a tree or plants; and a plastic hose with inserts, planted with the potato seed and picked up with the mature potatoes. (Knapp-USGS)
W70-08949

POTENTIAL EFFECTS OF SPRINKLED AGRICULTURE ON THE NORTH AMERICAN WATER BALANCE,
California Univ., Davis. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 02A.
W70-08995

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

AN APPROACH TO DETERMINE THE MINIMUM ALLOWABLE FLOW IN THE 'TISZA' RIVER FROM THE VIEWPOINT OF WATER QUALITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 05B.
W70-08633

MILHOUS V STATE HIGHWAY DEP'T (UNCONSTITUTIONAL TAKING OF PROPERTY FOR PUBLIC USE VIA OBSTRUCTION OF NATURAL FLOW OF SURFACE WATERS).

8 SE2d 852-857 (S C 1940).

Descriptors: *South Carolina, *Obstruction to flow, *State governments, *Eminent domain, *Highway effects, Surface drainage, Surface runoff, Alteration of flow, Drainage practices, Drainage systems, Legal aspects, Judicial decisions, Condemnation, Public rights, Relative rights, Right-of-way, Roadbanks, Highways, Administrative agencies, Repulsion (Legal aspects), Riddance (Legal aspects), Surface waters, Ditches, Reservoirs, Impounded waters.
Identifiers: *Constitutions.

Plaintiff landowner contended that defendant Highway Department had taken his property for public use without just compensation. Defendant allegedly had razed the grade of the road adjacent to plaintiff's property, had destroyed a pit previously serving as a temporary reservoir for surplus rainfall, and had replaced a drainage ditch with inadequate ones. Plaintiff's drainage was rendered inadequate and his land flooded. Defendant sought to distinguish surface water from natural watercourses, and contended it would be liable only if it collected surface water and threw it with force onto the land of another. The appellate court held that, as to the state, liability exists whether the taking of the property is by stream obstruction, by casting impounded surface water with force on another's land, or by the obstruction of the natural flow of surface water. Under the common law an individual may defend his property against surface waters under the common enemy rule, and he is not liable for resulting damages to his neighbor's lands. However, the common law and the Constitution afford a remedy against the state for one whose property is unconstitutionally taken. (Price-Florida)
W70-08703

KEENER V ADDIS (DAMAGES FROM DRAINAGE DITCH DISCHARGE).

5 SE2d 695-703 (Ga Ct App 1939).

Descriptors: *Georgia, *Ditches, *Riddance (Legal), *Repulsion (Legal aspects), Damages, Drainage effects, Drainage, Conveyance structures, Drainage engineering, Water conveyance, Surface drainage, Drainage practices, Surface waters, Sediment discharge, Routing, Gravels, Sediments, Sands, Crops, Crop production, Farms, Judicial decisions, Legal aspects, Land use, Impounded waters.

Plaintiff brought action to recover from defendant for injury done plaintiff's land and crops by water from a drainage ditch built by defendant. Plaintiff alleged that defendant had collected surface water on his land and by way of the ditch had discharged it onto plaintiff's property. The water, sand and gravel deposited on plaintiff's land resulted in the land's becoming unfit for the production of crops. Defendant contended that plaintiff was under a duty to avoid the consequences of the alleged nuisance. The Court of Appeals of Georgia ruled that plaintiff was under no duty to avoid the consequences since such duty arises only where the act complained of is a negligent act. The facts showded a positive act by defendant, not negligence. The measure of damages was the actual loss caused by the injury to the property. The trial court's judgment for the plaintiff was affirmed. (Barker-Florida)
W70-08714

GROOVER V HIGHTOWER (FLOOD DAMAGE FROM DAM CONSTRUCTION).
1 SE2d 446-449 (Ga Ct App 1939).

Descriptors: *Georgia, *Dams, *Damages, *Obstruction to flow, Natural flow doctrine, Streamflow, Riparian rights, Relative rights, Dam construction, Damsites, Sites, Sediment control, Barriers, Dam design, Overflow, Water control, Flood damage, Crops, Crop production, Sediments, Land use, Judicial decisions, Legal aspects, Flooding, Floods.

Plaintiff upstream landowners brought action for damages against defendant for injury caused to plaintiff's crops and land as a result of a dam built by defendant downstream from plaintiff's property. Plaintiff claimed that the water from the stream had backed up, thereby flooding his land and preventing the production of corn. Plaintiff also contended that the dam had restricted the flow of the stream so that sand, trash and other matter had accumulated in the stream which further contributed to the overflowing and flooding of his land. Defendant argued that the water had not backed up as far as plaintiff alleged and that the flow through plaintiff's land had not been impeded by construction of the dam. The trial court excluded defendant's testimony as to the rate of flow and the jury returned a verdict for plaintiff. The Court of Appeals of Georgia ruled that the evidence as to whether the dam retarded the flow should have been submitted to the jury. The trial court's decision was reversed. (Baker-Florida)
W70-08715

DICKEY V YARBROUGH (EXECUTION OF PAROL LICENSE BECOMES EASEMENT TO USE OF DITCH).
197 SE 234-235 (Ga 1938).

Descriptors: *Georgia, *Easements, *Obstruction to flow, *Ditches, Flow, Ponds, Legal aspects, Judicial decisions, Flow resistance, Flow control, Drainage, Drainage water, Remedies, Damages, Water injury, Water transfer, Cultivation, Expenditures, Land clearing, Relative rights.
Identifiers: *Injunction (Permanent).

Plaintiff and defendant were adjoining landowners. A pond on plaintiff's land flowed into a ditch which extended onto defendant's property. Defendant granted a parole license to plaintiff which authorized him to open and use the ditch in order to drain the pond. In reliance upon such authorization, plaintiff expended six dollars for the purpose of clearing the ditch. However, defendant subsequently threatened to close the ditch and actually placed obstructions therein. Plaintiff sought an injunction to prevent defendant from placing further obstructions in the ditch and from interfering with plaintiff's use of the ditch. Plaintiff maintained that if the ditch were closed, water would accumulate on his land and thereby cause him to incur damages, since a number of acres would be unfit for use and cultivation. In holding for plaintiff, the court stated that the parole license to open and use the ditch for the purpose of draining plaintiff's pond was irrevocable, and that plaintiff executed the license in making an expenditure, which converted such license into an easement running with the land. (Finman-Florida)
W70-08716

ELDER V BARNES (UPPER LANDOWNER REQUIRED TO REMOVE OBSTRUCTIONS FROM NATURAL DRAINAGE SYSTEM).

219 N C 411, 14 SE2d 249-252 (1941).

Descriptors: *North Carolina, *Obstruction to flow, *Natural streams, *Drainage systems, Depth, Downstream, Flow, Natural flow, Non-navigable waters, Surface waters, Channel improvement, Drainage, Legal aspects, Judicial decisions, Adjudication procedure, Natural flow doctrine, Relative rights, Riparian land, Riparian rights, Riparian waters, Surface runoff, Remedies, Repulsion (Legal aspects), Riddance (Legal aspects).

Plaintiff upper riparian landowner sought an order requiring defendant lower landowner to remove obstructions from a branch which ran through defendant's land and which had been the natural drain for plaintiff's land for forty years. The obstruction had caused water to collect on plaintiff's property. Defendant was ordered by the lower court to clear the branch and to improve a portion of it by constructing a ditch therein. Plaintiff was to improve another section of the branch in a like manner. Plaintiff complied with the order, but the defendant did not. The appellate court held that the evidence was sufficient to sustain the order of the lower court finding the defendant in contempt. Moreover, the lower court had acted within its power. The order was affirmed. (Price-Florida)
W70-08732

RICHMOND V DRAINAGE COMM'RS (RIGHT OF ACCESS TO LAND ACROSS DRAINAGE DITCH).
295 Ill App 338, 15 NE2d 6-8 (1938).

Descriptors: *Illinois, *Drainage districts, *Access routes, *Bridge construction, Bridges, Drainage systems, Local governments, Ditches, Tile drainage, Drains, Farms, Land tenure, Legislation, Administration, Judicial decisions, Legal aspects, Relative rights, Remedies, Administrative agencies.
Identifiers: Mandamus.

Plaintiff, in a petition for mandamus, sought an order requiring defendant drainage district to rebuild a bridge across a ditch running through plaintiff's farm. Defendant contended it was under no legal obligation to build the bridge. The court held that under the state's existing Farm Drainage Act the commissioners were not required to build the bridge. However, under a 1927 act plaintiff had the right, if necessary for free access to an enclosed parcel of land, to require the drainage district to build the bridge across the drain. The court noted that the area to which access was sought was enclosed by fences, and it would be necessary for plaintiff to travel a distance of four miles to reach the land if the bridge were not built. Therefore, the court found the site in question to be an 'enclosed' parcel of land within the meaning of the statute and held for plaintiff. (Hubener-Florida)
W70-08738

DANFORTH V UNITED STATES (TAKING OF LAND FOR LEVEE CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-08748

LYNN V UNITED STATES (EMINENT DOMAIN: COMPENSATION FOR OBSTRUCTION OF LAND DRAINAGE CAUSED BY INCREASED BACKWATER LEVEL).
For primary bibliographic entry see Field 06E.
W70-08749

IN RE COUNTY DITCH NO 50, FARIBAULT COUNTY (PARTIES DIRECTLY AND INDIRECTLY AFFECTED BY LATERAL DRAIN AND DITCH IMPROVEMENT PROCEEDINGS).
For primary bibliographic entry see Field 06E.
W70-08759

NIGHTINGALE V STATE (CLAIM FOR DAMAGES DUE TO EROSION CAUSED BY CANAL OPERATION).
For primary bibliographic entry see Field 06E.
W70-08765

HASKELL V STATE (NEGLIGENT OPERATION OF FLOOD CONTROL FACILITIES).
For primary bibliographic entry see Field 06E.
W70-08769

LOHMEYER V STATE (FLOOD DAMAGE CAUSED BY DEBRIS BLOCKING ARCHWAY OF STATE AQUEDUCT).
For primary bibliographic entry see Field 06E.
W70-08776

HOMES, INC V ANDERSON (RIGHT TO DIRECT DRAINAGE WATER ALONG NATURAL COURSE OF FLOW).
For primary bibliographic entry see Field 06E.
W70-08779

COX V DRAINAGE DIST NO 27 (NOTICE OF HEARING BY DRAINAGE DISTRICT REQUIRED FOR ADDITIONAL ASSESSMENTS).
For primary bibliographic entry see Field 06E.
W70-08782

GRAVES V LITTLE TARKIO DRAINAGE DIST NO 1 (FINANCING RECLAMATION PROJECTS).
For primary bibliographic entry see Field 06E.
W70-08785

HOGAN V COWART (DUTY NOT TO OBSTRUCT DRAINAGE THROUGH DITCH ACQUIRED BY EASEMENT).
For primary bibliographic entry see Field 06E.
W70-08787

KIRK V NORFOLK AND W RY (RECOVERY FOR PERMANENT WATER INJURY BARS FUTURE RECOVERY OF DAMAGES).

196 SE 501-503 (W Va 1938).

Descriptors: *West Virginia, *Pipes, *Railroads, *Overflow, Flow control, Remedies, Water injury, Damages, Flooding, Real property, Judicial decisions, Legal aspects, Darinage water, Drainage effects, Drainage systems, Surface waters, Flood control, Construction, Maintenance, Right-of-way, Flood damage, Floodwater.
Identifiers: *Permanent nuisance, Damages (Permanent).

Plaintiff owned a tract of land, abutting defendant railway company's roadbed and tracks, which defendant had constructed pursuant to a right-of-way granted by plaintiff's predecessor in title. Waters from nearby hills overflowed onto the tract through two drain pipes which defendant maintained under

its roadbed. Preciously, defendant had been held liable to plaintiff's predecessor in title for such damages to the tract which resulted from the flooded condition caused by this drainage. Subsequently, plaintiff purchased the tract and brought action to recover temporary damages from defendant which resulted from waters being drained onto plaintiff's property through the same drain pipes. Defendant contended that plaintiff was prohibited from collecting damages since a judgment for permanent injury had previously been awarded against defendant involving this same real property. The court held that the previous judgment and award of permanent damages to plaintiff's predecessor in title against defendant was a bar to plaintiff's recovery. As the construction and maintenance of the drain pipes under the roadbed caused a nuisance of a permanent nature, the court stated that the recovery of damages in the prior suit was permanent and final. (Finman-Florida)
W70-08789

BD OF EDUC V TOWN OF N HEMPSTEAD (LIABILITY FOR DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W70-08791

MENNITO V TOWN OF WAYLAND (LIABILITY FOR DAMAGES RESULTING FROM THE ALTERATION OF SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W70-08793

TENNESSEE A AND G RY V CARDON (DUTY TO MAINTAIN ADEQUATE DRAINAGE AFTER CONSTRUCTION OF DITCHES).
For primary bibliographic entry see Field 06E.
W70-08795

MODIFICATION OF THE RIPARIAN THEORY AND DUE PROCESS IN MISSOURI,
James D. Ellis.
Missouri Law Review, Vol 34, 1969, p 562-574.

Descriptors: *Missouri, *Riparian rights, *Water rights, *Prior appropriation, Water law, Permits, Water permits, Legal aspects, Legislation, State governments, Judicial decisions, Control, Administrative agencies, Regulation, Public health, Water allocation (Policy), Planning, Water policy.

The inefficiency and wasteful methods of regulating water use under the riparian doctrine have led some states to depart from riparian theory in favor of comprehensive regulatory acts concerning water use. Such states as South Dakota, Kansas, Oregon, Minnesota and Iowa have all followed this course and provide possible models for Missouri in changing riparian control. These acts generally preserve vested riparian interests as long as they are used in a beneficial manner. Courts have upheld the acts as valid exercises of the police power. Some of the acts provide for a state agency to establish a permit system to regulate the appropriation of water. The crucial question in state regulation is whether a riparian owner is entitled to compensation if his rights to the water are impaired. A South Dakota court has held that water rights are not sufficient property interests to allow the invocation of the right not to be deprived of property without due process of law, although that theory may not be acceptable in Missouri. However, it is possible that unexercised riparian rights may be curtailed without compensation being given. (Hubener-Florida)
W70-08811

ZONING THE FLOOD PLAINS OF OHIO.
Toledo Law Review, Vol 1969, p 655-676.

Descriptors: *Ohio, *Flood plain zoning, *Land use, *Rivers, Cities, Urbanization, Industries, Local governments, Sites, Water utilization, Regulation, Legislation, Flood plains, Flood damage, Building codes, Flood control, Flood plain insurance, Flood protection, Legal aspects, Regulation.

Prevention of flood damage can be accomplished most effectively by sound flood control programs and regulation of land development in areas subject to flooding by such means as zoning, subdivision regulation, building codes and community development policies. Flood plain zoning ordinances may be enacted pursuant to a state's police power if they are within the scope of state zoning enabling statutes. The most useful policy would be to permit some industries which are highly dependant upon water to locate within the flood plain if they would adopt necessary modes of floodproofing. However, residential areas should be excluded from flood plains since they have no need for locating near water and generally cannot afford the costs of floodproofing. In Ohio such zoning practices have been successfully utilized in urban areas but have not been effective in rural areas. The trend in Ohio is to the increasing use of restrictions on flood plain development. Increasing use of regulations should be spurred by the fact that such regulations are required for communities to qualify for federal flood insurance under the 1968 Housing Act. (Hubener-Florida)
W70-08813

COLE V BRADFORD (NO DUTY TO SHARE EXPENSES FOR REMOVING NATURALLY OCCURRING OBSTRUCTIONS).
184 SE 901-902 (Ga Ct App 1936).

Descriptors: *Georgia, *Obstruction to flow, *Natural flow, *Riparian rights, Remedies, Legal aspects, Judicial decisions, Riparian land, Riparian waters, Natural flow doctrine, Alteration of flow, Diversion, Water law, Overflow, Streamflow, Streams, Expenditures, Real property, Water injury, Duty of water, Relative rights.

Naturally occurring obstructions from defendant's lower riparian property caused stream water to overflow onto plaintiff's upper riparian land. Plaintiff requested permission to enter defendant's land, after due notice, in order to clear the stream of such obstructions, and furthermore requested defendant to share the expenses of removing these obstructions. Defendant permitted plaintiff to enter upon his property to clear the stream, but insisted that this was to be done at plaintiff's own expense. Plaintiff brought action to compel defendant to share these expenses. The court stated the rule that an upper riparian owner is entitled to have the water of a stream flow naturally from his land, but a riparian owner is not to be held responsible for the effects of nature which cause obstructions in a stream. Furthermore, such riparian owner owes on duty to either a lower or upper riparian owner to remove such naturally occurring obstructions. Therefore, as defendant was under no duty to remove these obstructions, the court held he was not liable to share plaintiff's expenses in removing such obstructions. (Finman-Florida)
W70-08821

COMM'RS OF UNION DRAINAGE DIST NO 1 v COMM'RS OF UNION DRAINAGE DIST NO 2 (APPORTIONING COSTS OF DRAINAGE DISTRICT IMPROVEMENTS).
373 111 347, 26 NE 2d 85-88 (1940).

Descriptors: *Illinois, *Drainage districts, *Drainage systems, *Cost sharing, Cost repayment, Local governments, Ditches, Drains, Farms, Land tenure, Bridge construction, Legislation, Administration, Judicial decisions, Legal aspects, Compensation, Bridges, Flood control, Silting, Watersheds (Basins), Administrative agencies, Administration.

The commissioners of plaintiff drainage district instituted this proceeding to determine what share of the cost of cleaning and widening the main ditch in their district should be borne by defendant, an adjoining drainage district. Plaintiffs also requested that defendants should bear a portion of the costs of lengthening bridges spanning the ditch. Although evidence conflicted as to the benefits defendants obtained from the project and from plaintiffs' drainage ditch, the court held that the preponderance of the evidence showed defendant district was benefited by the cleaning and widening of the ditch in question. Since the land in both districts was part of the same watershed, and since plaintiffs' land sloped gradually down into defendants' land, the court noted that land would be flooded in both districts if no ditches were constructed. Defendant would also be benefited in that water would flow faster from plaintiffs' ditch and tend to loosen silt in defendants' ditch. The court ordered that costs be shared in proportion to the area of land in each district. Also, a share of the cost of bridge lengthening was properly chargeable to defendants. (Hubener-Florida)
W70-08823

R DUNKEL, INC V BARLETTA CO (OBSTRUCTION OF UNDERGROUND STREAM).
18 NE2d 377-379 (Mass 1938).

Descriptors: *Massachusetts, *Streamflow, *Obstruction to flow, *Conduits, Alteration of flow, Average flow, Culverts, Structures, Cofferdams, Outlet works, Overflow, Control structures, Damages, Legislation, State governments, Underground, Subsurface waters, Underflow, Judicial decisions, Legal aspects, Construction.
Identifiers: *Negligence.

A creek flowed through a culvert located beneath the floor of a basement in plaintiff's buildings. Following a heavy rain, water overflowed the culvert and entered the basement, causing damage to goods stored therein. Plaintiff sued defendants who were constructing a conduit to lead water away from plaintiff's premises. Plaintiff alleged that negligent methods caused obstruction to the flow of the creek which resulted in the overflow into his basement. Plaintiff contended that creation of the obstruction was negligence per se. The court, in holding for defendants, stated that the conduit could not have been constructed without obstructing flow and, therefore, defendant was not liable unless the erection of the obstruction was performed in a negligent manner. The question of negligence was for a jury to decide. As the acts of defendants were required in the performance of a contract with the state, plaintiff's remedy was confined to the means provided in the statute which authorized the construction of the conduit. (Hubener-Florida)
W70-08839

WATERSHED MODELING BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 06A.
W70-08860

PERFORMANCE OF AN ASPHALT TREATED DRAINAGE BLANKET IN A FLEXIBLE PAVEMENT SECTION,
California State Div. of Highways. Materials and Research Dept.
Travis Smith, Raymond Forsyth, and Wesley Gray.
Interim Report M and R No 632618, Dec 69, 43 p, 14 fig, 4 tab, 7 ref.

Descriptors: *Paving, *Drainage, *Highways, Road construction, Asphalt, California, Performance.
Identifiers: Drainage blankets, *Flexible pavements.

The paper presents the results of a field evaluation of a two-layer highway drainage system on Road 299 between Arcata and Willow Creek in the northern coastal region of California. The experimental section consisted of 400 feet utilizing a two-layer drainage blanket, the top, or drainage element, of which was stabilized with asphalt and 200 feet of normal single-layer drainage blanket to

serve as a control. The section was located in a cut section with numerous springs and seeps in a high rainfall area. Both sections effectively drained all subsurface water at the site through an unusually wet winter and spring.
W70-09005

4B. Groundwater Management

RESISTANCE NETWORK FOR THREE-DIMENSIONAL UNCONFINED GROUNDWATER PROBLEMS WITH EXAMPLES OF DEEP WELL DEWATERING,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and R. Herbert.
The Institute of Civil Engineers - Proceedings, Vol 45, Session 1969-70, p 471-490, March 1970. 14 fig, 18 ref, 1 append.

Descriptors: *Resistance networks, *Aquifers, *Groundwater, *Mathematical (Studies), Models, *Numerical analysis, Deep wells, Cutoff walls, Design.
Identifiers: Multiwell dewatering installation.

The use of the electrical resistance network in analyzing complex unconfined groundwater flow problems was discussed. The first part was concerned with the techniques of representing the aquifer, wells and cut-off walls and also stationary and moving water tables. The resistance network method was described and illustrated by considering a full-time varient solution. The factors affecting a groundwater solution were listed. Mathematical solutions to unconfined well problems were divided into two groups. The first group consisted of formulae which assumed only horizontal flow because the water table is effectively horizontal. In the second type, the flow is not horizontal. Owing to the limitation of mathematical solutions, numerical solutions to groundwater problems were attempted. The resistance network solution can include wells, cut-off walls and any form of non-homogeneous aquifer and was used for a variety of practical engineering problems. The analysis of a multiwell dewatering installation was shown as an example of a quick, more economical technique. The results from many different dewatering systems were summarized and an approximate design method based on the results was proposed. The design method was then tested against a dewatering problem for which a case history was available. The accuracy and implications of the design method were discussed. (Kriss-Cornell)
W70-08849

4C. Effects on Water of Man's Non-Water Activities

ENVIRONMENTAL IMPACT OF THE BIG CYPRESS SWAMP JETPORT.
Department of the Interior, Washington, D.C.

U S Department of the Interior Report, 1969. 153 p, 19 fig, 4 tab.

Descriptors: *Urbanization, *Ecology, *Swamp, *Florida, *Airports, Aquatic environment, Marshes, Drainage systems, Land use, Environmental effects, Habitats, Highway effects, Ecosystems.
Identifiers: Florida jetport, Big Cypress Swamp, Everglades Park.

Development of the proposed Big Cypress Swamp jetport, Florida and attendant facilities will lead to land drainage and development for agriculture, industry, housing, transportation, and services in the Swamp which will destroy the south Florida ecosystem and Everglades National Park. Construction of each training strip will destroy about 400 acres of natural habitat. No significant problems are expected from the limited sewage, industrial wastes or pesticides in the training phase. Air pollutants from engine exhausts will be substantial. There will be frequent high level noise intrusion on the wilderness character of the northern part of Everglades National Park and even more on the Big Cypress and Conservation Area No. 3. A severe bird strike problem may develop within the airport boundaries. With sufficient culverts provided through runways, ramps, roads, and other facilities, interference with overland flow will be negligible. The combination of bird strikes, pest insect problems and incidence of small animals on runways will probably lead to drainage of at least part of the jetport property. Construction and imminent operation of the first training strip have elevated surrounding land prices and sales. Economic and social pressures for further development within and without the port property will mount rapidly. Land development and drainage will be accompanied by increased nutrients in the water, will alter the hydroperiod, and will promote eutrophication. (Lang-USGS)
W70-08596

DETERMINATION OF THE POLLUTIONAL EFFECT OF SURFACE RUNOFF,
Ministry of Land Reclamation and Water Economics, Minsk (USSR). Inst. of Water Problems.
For primary bibliographic entry see Field 05C.
W70-08639

URBANIZATION AND THE WATER BALANCE,
Geological Survey, Washington, D.C. Water Resources Div.
Andrew M. Spieker.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 182-187, 1969. 2 fig, 8 ref.

Descriptors: *Urbanization, *Rainfall-runoff relationships, *Water pollution sources, Cities, Silts, Time lag, Sediment load, Erosion, Silting, Water supply, Waste disposal, Withdrawal, Surface-groundwater relationships, Subsidence, Floods, Hydrographs, Peak discharge, Low flow.
Identifiers: Urban hydrology, North America.

Urbanization modifies the hydrologic balance by causing changes in the distribution and quality of water in time and place. The overall quantity of water, however, remains essentially unchanged. In extreme cases, the lack of adequate management measures can result in catastrophic events. Several examples are cited. In 1969 floods in southern California were intensified by uncontrolled urban sprawl in alluvial fans and canyons. Sewering of urbanized areas on Long Island has caused an increase in direct runoff and flood peaks, and a lowering of groundwater levels. Detailed studies of storm runoff in Fairfax County, Virginia, have shown that urbanization in small watersheds increases peak flow by 2 to 3 times, and shortens the lag time by about 8 times. Intensive construction in urbanizing areas can result in sharply increased sediment loads in streams and lakes. Chemical and bacterial quality of water are also affected by urbanization. Studies of Salt Creek, a small stream in suburban Chicago, indicate high coliform and BOD levels at both low and high flows. Coliform counts are greater at high flows, resulting from combined sewer overflows. (See also W70-08597)
W70-08990

PERFORMANCE OF AN ASPHALT TREATED DRAINAGE BLANKET IN A FLEXIBLE PAVEMENT SECTION,
California State Div. of Highways. Materials and Research Dept.
For primary bibliographic entry see Field 04A.
W70-09005

4D. Watershed Protection

AN OPERATIONAL WATERSHED MODEL STEP 1-B: REGULATION OF WATER LEVELS IN THE KISSIMMEE RIVER BASIN,
Central and Southern Florida Flood Control District, West Palm Beach.
Lalit K. Sinha.
Water Resources Bulletin, Vol 6, No 2, p 209-221, March-April 1970. 5 fig, 3 tab, 12 ref.

Descriptors: *Mathematical models, *Simulation analysis, *Watershed management, *Water levels, *Spatial distribution, *Temporal distribution, Gradually varied flow, Spillway gates, Lake stages, Florida.
Identifiers: Mean daily water surface elevation, Kissimmee River Basin.

Step - 1B in the first phase of an 'Operational Watershed Model' recently initiated by the Central and Southern Florida Flood Control District for managing its water resources was to compute water surface elevation, spatially and temporarily, in the Kissimmee River Basin system of reservoirs, channels and spillways. The approach was based upon the principles of gradually varied flow and consisted of two parts. One, a qualitative delineation of the basin into typical systems and two, the development of mathematical models to compute lake stage as a function of storage, and to compute discharge through the control structures as a function of gate opening and differential head across the structures. Their feasibility for application was demonstrated by the simulation of mean daily water surface elevation for a period of two years on the tail side of one typical gated spillway and on the head side of another gated spillway. (Kriss-Cornell)
W70-08858

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

DETERMINING THE DISSOLVED OXYGEN IN SMALL QUANTITIES OF WATER,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
D. A. Jones.
Corrosion, Vol 26, No 7, p 151-154, June 1970. 4 p, 2 fig, 1 tab, 5 ref. AEC Contract No AT (45-1)-1830.

Descriptors: *Sampling, Water analysis, *Dissolved oxygen, Corrosion, Boiler feed water, Corrosion control, Chemical analysis, Analytical techniques.
Identifiers: Dissolved oxygen analysis.

A method is suggested in which water for dissolved oxygen analysis is drawn directly into a small evacuated sampling vessel to preclude contamination from atmospheric oxygen yet not seriously deplete a limited water supply. The indigo-carmine colorimetric method and the polarographic method were modified to determine the dissolved oxygen in a filled sample vessel. (Knapp-USGS)
W70-08594

INSTRUMENTATION IN WATER QUALITY MONITORING AND SAMPLING,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
R. M. Gale.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 141-154, Vol 1, 1969. 14 p, 7 ref.

Descriptors: *Water quality, *Monitoring, *Sampling, *Instrumentation, Data processing, Data transmission, Telemetry, Data collections, Water pollution, Water chemistry, Water analysis.
Identifiers: Water quality instrumentation, Canada.

The methods used in Canada for water quality monitoring and water sampling are discussed and the advantages and disadvantages of these methods are pointed out. The factors which govern the need for and the location of water quality instrumentation are discussed, with particular emphasis on economics. Installation methods to meet specific requirements under conditions such as weather and location are described. Methods of recording, transmitting and processing data produced by monitoring equipment are outlined and the usefulness of these data in determining water quality variations, optimum sampling frequencies, and general pollution conditions are briefly discussed. (Knapp-USGS)
W70-08616

THE QUANTITATIVE RELATION OF BACTERIA AND CILIATES TO WATER POLLUTION,
Czechoslovak Academy of Sciences, Prague. Hydrobiological Station.
Vera Straskrabova, and Milos Legner.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Caechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 57-67, 1969. 11 p, 6 fig, 3 tab, 13 ref.

Descriptors: *Biomass, *Bacteria, *Protozoa, *Water pollution, Biochemical oxygen demand, Dissolved oxygen, Reservoirs, Streams, Rivers, Sewage, Foreign research, Bioindicators.
Identifiers: Czechoslovakia.

To study the quantitative relationships between organisms and the organic load in stream self-purification, 195 water samples were analyzed from reservoirs, brooks, rivers and sewage. All the organisms studied showed a direct relationship between their quantity and concentration of decomposable organic substances present. The bacterial numbers to BOD ratio was different in static and flowing waters for colonies on beef-peptone agar, whereas for direct counts on membrane filters no difference between the two types of water bodies was found. Most of the planktonic bacteria in moderately polluted surface waters are unable to grow on agar media. The relationship between the production of ciliates and the bacterial number was different for different species. (Woodard-USGS)
W70-08630

WATER QUALITY PROTECTION PLANS IN RIVER BASINS,
Institute of Hydrotechnical Research, Bucharest (Rumania). Surface Water Lab.
For primary bibliographic entry see Field 05G.
W70-08632

THE PROBLEM OF THE CYTOTOXICITY OF WATER,
Paris Health Lab. (France).
For primary bibliographic entry see Field 05C.
W70-08634

THE PREDICTION OF THE DISTRIBUTION OF DISSOLVED OXYGEN IN RIVERS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05B.
W70-08636

STATISTICAL CHARACTERIZATION OF MIXTURES OF HYDROCARBONS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland); and Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
J. Ruchti, and H. R. Krahenbuhl.
Advances in Water Pollution Research, Proceedings, 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 205-211, 1969. 7 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Water pollution sources, *Pollutant identification, *Oils, *Oily water, *Gas chromatography, Computers, Data processing, Foreign research, Statistical methods, Analytical techniques.
Identifiers: *Characterization, *Hydrocarbons, *Mixtures.

The possibility of characterizing oils by statistical treatment of their gas chromatographic behavior is discussed. In principal, complex mixtures of hydrocarbons can be characterized and distinguished by the proposed average gas chromatographic retention times. The following oils were used in the experiments: octane fraction, benzine fraction, nonane fraction, terpenaline fraction, decane fraction, petrol special, kerosene fraction, undecane fraction, fuel oil extra light, AVIA fuel oil, BP long-life, BP SAE-30, used oil, and crude oil. Calculations were performed on the Control Data 1604-A computer of the computation center at the Swiss Federal Institute of Technology, Zurich. (Woodard-USGS)
W70-08640

PHYSICAL AND BIOCHEMICAL ASPECTS OF B.O.D. KINETICS,
Karlsruhe Univ. (West Germany). Inst. of Engineering Biology.
Ludwig Hartmann, and Peter Wilderer.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 241-251, 1969. 11 p, 7 fig, 9 ref, 2 append.

Descriptors: *Water pollution effects, *Biochemical oxygen demand, *Kinetics, Laboratory tests, Chemical reactions, Equations, Dissolved oxygen.
Identifiers: BOD Kinetics.

Based on theoretical and literature studies, experiments were made in an attempt to formulate a new mathematical equation for the BOD process. The same substrate concentration was brought into contact with different amounts of adapted activated sludge; thus different load values were obtained. The synthetic sewage consisted of Liebig's meat extract. (Woodard-USGS)
W70-08641

DIGITAL SIMULATION SYSTEM FOR PREDICTION OF WATER QUALITY,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W70-08642

SUGGESTED CLASSIFICATION OF WATER QUALITY BASED ON BIOLOGICAL CHARACTERISTICS,
Water Management Center, Erfurt (East Germany).
Wolf von Tumpling.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 279-286, 1969. 8 p, 2 fig, 3 tab, 27 ref.

Descriptors: *Classification, *Water quality, *Biological properties, *Statistical methods, Biochemical oxygen demand, Dissolved oxygen, Foreign research, Water pollution effects, Water utilization.
Identifiers: *Saprobic index, German Democratic Republic.

Water quality ranging from high purity to very highly polluted conditions is classified and related to appropriate water uses, based on statistical investigations of biological state and oxygen balance. Other data show relationships between saprobic index and dissolved oxygen deficit, biological oxygen demand and ammonium ion concentration; between degree of saprobity and dissolved oxygen deficit, biochemical oxygen demand, and ammonium ion concentration; and between the degree of saprobity and the biochemical oxygen demand. (Woodard-USGS)
W70-08643

A RAPID METHOD FOR ORTHOPHOSPHATE ANALYSIS AT HIGH CONCENTRATIONS IN WATER,
National Inst. for Water Research, Pretoria (South Africa).
J. E. Harwood, R. A. van Steenderen, and A. L. Kuhn.
Water Research, Vol 3, p 417-423, 1969. 2 fig, 1 tab, 18 ref.

Descriptors: *Phosphorus, *Analysis, Calibrations, Analytical techniques, Phosphorus compounds.
Identifiers: Orthophosphates, Organic phosphorus, Antimony, Ascorbic acid.

Range of linear portion of calibration curve for determination of orthophosphate by Murphy and Riley (1962) method is increased by using greater quantities of antimony. Antimony as a catalyst was found to be bound in 1:1 ratio with ascorbic acid reduced molybdophosphoric acid complex. Range of phosphorus tested was 10-150 micrograms. Sensitivity was not appreciably increased. Proposed method can be extended to trace quantities by using large aliquots and/or larger cell path length. Interference from condensed phosphates and cyanic phosphate was minimal. Interference from labile phosphorus was significant. (Bannerman-Wisconsin)
W70-08667

COMPUTER MODEL OF CONNECTICUT RIVER POLLUTION,
United Aircraft Corp., East Hartford, Conn. Research Labs.
For primary bibliographic entry see Field 05G.
W70-08843

SEPARATION OF PHENOLS IN WATERS BY THIN LAYER CHROMATOGRAPHY,
National Research Centre, Cairo (Egypt). Water Pollution Dept.
For primary bibliographic entry see Field 05F.
W70-08901

AN EVALUATION OF THE STANDARD BIOCHEMICAL AND ELEVATED TEMPERATURE TESTS FOR DIFFERENTIATING FAECAL AND NON-FAECAL COLIFORMS,
Central Public Health Engineering Research Inst., Nagpur (India).
For primary bibliographic entry see Field 05D.
W70-08913

THE APPLICATION OF PHASE SELECTIVE ALTERNATING CURRENT POLAROGRAPHY TO THE ANALYSIS OF HEAVY METALS IN WATER,
Georgia Inst. of Tech., Atlanta. Environmental Resources Center.
Peter E. Sturrock, and Robert L. Poole, Jr.
Available from the Clearinghouse as PB-193 412, $3.00 in paper copy, $0.65 in microfiche. Completion Report, June 1970. 55 p, 4 fig, 21 ref. OWRR Project A-020-GA (1).

Descriptors: *Polarographic analysis, *Heavy metals, *Electrolysis, *Aqueous solutions, *Elec-

troanalytical techniques, Electrolytes, Ions, Water pollution, Water treatment.
Identifiers: *Alternating current polarography, *Square-wave polarography.

The suitability was investigated of phase selective alternating current polarography and square-wave polarography for analyzing water for low concentrations of heavy metal ions. The application of phase selective alternating current polarography for analysis of heavy metals in water is examined in detail. Use of square-wave polarography is examined to a lesser degree. A variety of heavy metal ions are examined and optimum conditions for analyzing the individual ions are documented. Conditions are given for analyzing various multicomponent mixtures. Problems due to interferences from surfactants on ac polarographic techniques and methods for eliminating interferences are set out. Both selective ac and square-wave polarography were suitable for water analysis. Square-wave polarography was the more sensitive. The selective ac technique was very suitable for analysis of multicomponent systems. (Conway-Georgia)
W70-08986

5B. Sources of Pollution

THE QUANTITATIVE RELATION OF BACTERIA AND CILIATES TO WATER POLLUTION,
Czechoslovak Academy of Sciences, Prague. Hydrobiological Station.
For primary bibliographic entry see Field 05A.
W70-08630

AN APPROACH TO DETERMINE THE MINIMUM ALLOWABLE FLOW IN THE 'TISZA' RIVER FROM THE VIEWPOINT OF WATER QUALITY,
Research Inst. for Water Resources Development, Budapest (Hungary).
Bela Hock.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 75-86, 1969. 12 p, 4 fig, 3 tab, 10 ref.

Descriptors: *Forecasting, *Water quality, *Reservoirs, *Irrigation water, *Water quality control, Water resources, Streamflow, Biochemical oxygen demand, River forecasting, River regulation, Equations, Foreign research.
Identifiers: *Tisza River (Hungary).

Existing reservoirs and future construction of water storage systems on the Tisza River in Hungary for irrigation purposes will fundamentally change the water regime of the river and create problems regarding water pollution management. To solve these problems, forecasting the future water quality is necessary. The correlation between the different components of water quality and the flow are characterized by equations. By using the appropriate corrections, the equations can be used for forecasting water quality of the river in 1980. The minimum allowable flow from the reservoir is based on a maximum concentration of 10 mg/l permanganate biochemical oxygen demand value. (Woodard-USGS)
W70-08633

WATER RESOURCES STUDIES IN THE ARA VALLEY,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
For primary bibliographic entry see Field 05B.
W70-08635

WATER RESOURCES STUDIES IN THE ARA VALLEY,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
A. Sugiki, T. Matsuo, and K. Tanaka.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 107-119, 1969. 13 p, 5 fig, 8 tab, 5 ref, 2 append.

Descriptors: *Water resources development, *Planning, *Water pollution control, *River basins, *Urbanization, Water conservation, Water demand, Regulation, Equations, Foreign research, Systems analysis, Zoning.
Identifiers: *Industrailization, Ara Valley, Tokyo (Japan).

Water pollution control of rivers flowing through metropolitan areas requires particular study in Japan because of the many problems created by the rapid pace of urbanization and industrialization. In 1985 about 80% of Japan's population will dwell in urban areas and industrial production will be 7-8 times greater than at present. With these drastic developments it is necessary to determine how rivers may be maintained free of pollution. A plan is proposed for water conservation in Japan, illustrated by the Ara Valley Area, a typical polluted river in the Tokyo Metropolitan Area, as a case study. A general description is given of the present and future conditions of the Ara River Basin. Future water demands and pollution loads are predicted. Regulation of industrial development is proposed as a regional planning approach to overcome an inevitable water quality deterioration, and the effects of regulation of industrial development are considered. A systems analytical method is applied to obtain an economically and technically optimum water conservation plan for the proposed basin. (Woodard-USGS)
W70-08635

THE PREDICTION OF THE DISTRIBUTION OF DISSOLVED OXYGEN IN RIVERS,
Water Pollution Research Lab., Stevenage (England).
M. Owens, G. Knowles, and Anne Clark.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 125-137, 1969. 13 p, 7 fig, 2 tab, 19 ref.

Descriptors: *Water quality, *Forecasting, *Dissolved oxygen, *Rivers, Velocity, Equations, Light intensity, Temperature, Aquatic weeds, Photosynthesis, Foreign research.
Identifiers: River Ivel (England).

Equations are formulated for predicting the widely varying concentrations of dissolved oxygen that occur in a non-polluted reach of a shallow river (River Ivel, in England) from such data as light intensity, temperature, amount of aquatic weed present, initial oxygen content, and photosynthetic and respiratory rates of aquatic plants and benthic material. (Woodard-USGS)
W70-08636

STATISTICAL CHARACTERIZATION OF MIXTURES OF HYDROCARBONS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland); and Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 05A.
W70-08640

PHYSICAL AND BIOCHEMICAL ASPECTS OF B.O.D. KINETICS,
Karlsruhe Univ. (West Germany). Inst. of Engineering Biology.
For primary bibliographic entry see Field 05A.
W70-08641

DIGITAL SIMULATION SYSTEM FOR PREDICTION OF WATER QUALITY,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. T. Jaske.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 261-271, 1969. 11 p, 6 fig, 2 tab, 10 ref. AEC Contract AT (45-1) 1830.

Descriptors: *Forecasting, *Water quality, *Digital computers, *Systems analysis, *Columbia River, Equations, Meteorological data, Streamflow, Channel morphology, Biochemical oxygen demand, Dissolved oxygen, Density currents.
Identifiers: *Time-of-travel (Streams).

Water releases from Lake Roosevelt and other impoundments in the Columbia River between the Grand Coulee Dam and the Hanford plant have increased the travel time, introduced complicating density currents, and generally made a digital simulation system necessary to take advantage of the use of a great number of separate coefficients. Statistical studies are not necessary for each studied reach, and readily available dimensional, flow and weather data may be used. The basic system is readily adapted to the addition or deletion of subprograms without requiring the necessity to remeasure the overall coefficients. Further, the system is capable of adjusting, variables stochastically in response to primary inputs. The system when tested against a set of real data is capable of synthesizing to within 10% on short runs and less than 10% of records on longer runs. Temperatures have been consistently predicted to an accuracy of 0.25 deg C over a yearly period between regional points 200 to 500 km apart using a maximum of three weather station inputs. (Woodard-USGS)
W70-08642

INVESTIGATIONS OF THE RESIDUES OF CHLORINATED INSECTICIDES IN GROUNDWATER (In Italian),
Florence Univ. (Italy). Inst. of Hygiene.
C. Grasso.
Bollettino della Societa Italiana di Biologia Sperimentale, Vol 44, No 20, p 1701-1702, 1968.

Descriptors: *Groundwater, *Chlorinated hydrocarbon pesticide, Osmosis, Insecticides, Water purification, Soils.
Identifiers: Italy, Natural filtration.

Studies were made to determine whether insecticide residues are present in subterranean waters or whether they are eliminated by natural filtration; and whether substrates retain greater amounts of chlorinated insecticides than eliminated by artificial purification. Sampling included oligotrophic, mesotrophic and eutrophic waters and springs of different geophysical characteristics and in localities of diversified agricultural exploitation. Sampling was accomplished by gas chromatographic method with an electron capture detector (strontium-90). No chromotograms evidenced chlorinated insecticidal residues. Natural filtration adsorbs undesirable chemicals which have a prolonged life in soils, water, food, and animal organs. (Auen-Wisconsin)
W70-08659

RESEARCH OF THE RESIDUES OF CHLORINATED INSECTICIDES IN THE SURFACE WATER USED FOR DRINKING (In Italian),
Florence Univ. (Italy). Inst. of Hygiene.
C. Grasso.
Bollettino della Societa Italiana di Biologia Sperimentale, Vol 44, No 20, p 1702-1703, 1968.

Descriptors: *Insecticides, *Potable water, *Chlorinated hydrocarbon pesticides, Water pollution effects, Water pollution sources, Chlorination, Toxicity, Surface waters, Water purification.
Identifiers: Italy, Arno River, Bientino River.

nsecticide usage, initially in agriculture, has extended its scope to the realm of hygiene, sanitation, nd disease prevention. The residual toxicity was esearched in potable waters of the Arno and Bienino Rivers (Italy) as well as the efficacy of purifiation plants located at Anconella (Florence) and t Stagno (Liverno). Sampling was concentrated ear the purification plants, analyses detecting the ollowing chlorinated insecticides (listed in escending order of ppm): lindane, heptachlor, poxide of heptachlor, aldrin, dieldrin, DDE, DDD, nd pp'DDT. No organophosphate insecticides ere detected and it was surmised that they were egraded by the alkaline water of the rivers (pH .8-8.3). Unpurified water contained relatively low nsecticide concentrations, ostensibly diminished y sedimentation, flocculation, and filtration. hlorination failed to produce detectable results. Hypothetical conclusion is that insecticide concenrations are decreased by physico-mechanical rocesses, with no evident effect exerted by hlorination at the rate of 1 milligram/liter. (Auen-Visconsin)
W70-08660

NITRATE CONTENT OF THE UPPER RIO GRANDE AS INFLUENCED BY NITROGEN FERTILIZATION OF ADJACENT IRRIGATED LANDS,
Agricultural Research Service, Riverside, Calif. Salinity Lab.; Bureau of Reclamation, El Paso, Tex.; and International Boundary and Water Commission, El Paso, Tex.
C. A. Bower, and L. V. Wilcox.
Soil Science Society of America Proceedings, Vol 33, No 6, 1969. 1 fig, 3 tab, 11 ref.

Descriptors: *Nitrates, *Nitrogen, *Rio Grande, *Subsurface drainage, Drainage water, Salinity, Fertilizers, Groundwater, Irrigation effects, Leaching, Denitrification, River flow, Water pollution sources.
Identifiers: Upper Rio Grande, Salt balance.

An analysis of salt balance conditions on three irrigated areas along Upper Rio Grande between 1934-1963 is summarized. Nitrate content of water before irrigation and of drainage water was of specific interest. During 30-year period amount of nitrogen fertilizer applied increased by 35- to 100-fold. Decreasing annual river flows were major cause of significant increase of average annual nitrate load of river between 1954-1963 period. Increased use of nitrogen fertilizer in three areas has not increased overall nitrate nitrogen in Upper Rio Grande. El Paso Valley has slightly increased river nitrate nitrogen due to very low flows and sewage effluent. Insignificant contribution of nitrate nitrogen load to river from Rincon and Mesilla valleys was result of denitrification of leached nitrate nitrogen under anaerobic conditions in water saturated soil. (Bannerman-Wisconsin)
W70-08662

2,4-D CONTAMINATION AND PERSISTENCE IN IRRIGATION WATER,
Bureau of Reclamation, Denver, Colo.
T. R. Bartley, and A. R. Hattrup.
Paper at 23rd Annual Meeting of Western Society of Weed Scientists, Sacramento, Calif, Mar 1970. 32 p, 13 fig, 1 tab.

Descriptors: *Irrigation canals, Irrigation ditches, Spraying, *2-4-D, *Irrigation water, Water quality, Water analysis, Water sampling, Weeds, Herbicides, *Pesticide residues, Pesticides, Tolerances (Plant), *Weed control, Contamination, Water pollution sources, Water pollution.
Identifiers: Columbia Basin Project, Wash.

Concentration of 2,4-D in irrigation water and the rate of decline as the water moved downstream were studied by analyzing water samples collected from 18 irrigation canals on the Columbia Basin Project, Wash. The ditchbanks along these canals received routine applications of 2,4-D for control of weeds. Maximum concentration of 2,4-D found in each canal ranged as follows: 6 to 28 ppb in 9 canals, 38 to 100 ppb in 8 canals, and 214 ppb in one canal. In the 9 canals having the very low concentrations, the decline of the peak level of 2,4-D was very gradual as the water moved downstream. The peak levels in the canals with the higher concentrations showed some rises and declines at sampling stations below the first sampling site. This study indicates that the dimethylamine formulation of 2,4-D is persistent for several miles in irrigation water without much decline in concentration. In most cases, those canals carrying the greater quantity of water (74 to 840 cfs) contained the lowest levels of 2,4-D, and the higher levels occurred in flows ranging from 6.8 to 56 cfs. Waterflow, application rate, and herbicide spray overlap onto the water surface are major factors influencing herbicide concentration in irrigation water. (USBR)
W70-08681

THE BOD OF TEXTILE CHEMICALS,
American Association of Textile Chemist and Colorists, Durham, N.C.
William Stafford, and Harold J. Northup.
American Dyestuff Reporter, Vol. 44, No. 11, p 355-359, May 23, 1955. 1 tab, 1 fig, 8 ref.

Descriptors: *Biochemical oxygen demand, Water pollution, Rhode Island, Detergents.
Identifiers: *Textile mill wastes, Textile chemicals.

A study was made by the Rhode Island Sectional Stream Pollution Committee to make available BOD data on textile chemicals and dyes. The 5-day BOD's of 154 chemicals are given. Long-term BOD should be determined on chemicals with low 5-day BOD. By using low-BOD chemicals whenever possible, stream pollution is greatly reduced. However, some chemicals with a low BOD have other objectionable qualitites. High BOD per se does not eliminate a chemical from use as cost and efficiency must be considered. Large quantitites of low-BOD detergents may result in commulative detergent pollution. (Lonon-North Carolina State)
W70-08735

DETERGENTS - TODAY AND TOMORROW,
Gardinol Chemical Co.
Peter H. A. Strasser.
Textile Journal of Australia, Vol 40, No 5, p 12-13, 38, 41-43, May, 1965. 6 fig.

Descriptors: *Biodegradation, *Detergents, Sewage treatment, Water pollution.
Identifiers: *Textile mill wastes, Wool, Wool scouring.

The problem of biodegradability has stimulated a large amount of research in the detergent industry. The detergents now used are degraded about 60 percent in 24 hours in a sewage treatment plant. However, some authorities feel degradability should be at least 80 percent in 24 hours. As most of Australia's large centers of population have water sources independent of long rivers, the detergent-pollution problem is not very great there. The history of and research in detergents, particularly as related to wool scouring, is discussed at some length. (Lonon-North Carolina State)
W70-08737

BIODEGRADABLE DETERGENTS - SOFT DETERGENTS,
Hart Chemical Ltd., Guelph (Ontario).
H. Zimmerman.
Canadian Textile Journal, Vol. 82, p 43-45, January 22, 1965. 3 fig.

Descriptors: *Alkylbenzene sulfonates, *Biodegradation, Detergents, Water pollution, Waste waters, Biochemical oxygen demand, Fish, Algae, Foaming, Sewage treatment.
Identifiers: *Textile mill wastes, Alfol alcohols.

The alkyl aryl sulphonates are non-biodegradable, whereas soaps, the fatty alcohol sulphates and other fat based detergents, are readily biodegradable. These biodegradable synthetic detergents are available, but their use does not solve the over-all problems of water pollution. Nearly all waste waters from textile operations have a high BOD which affects fish life. The degradation of an alkyl aryl sulphonate in a sewage treatment process is only about 50 percent, and in river water is only about 75 percent in 30 days. The chemistry of alkyl benzene sulphonates (ABS) and the alfol alcohol process is discussed. The major nuisances from ABS residues are foaming and algal growths. There is little evidence that ABS residues are toxic to humans or fish, but the foaming adversely affects sewage treatment. (Lonon-North CarolinaState)
W70-08740

AIR AND WATER POLLUTION: WHAT TO DO WHILE WAITING FOR WASHINGTON,
For primary bibliographic entry see Field 06E.
W70-08802

EFFLUENT CHARGES AND THE INDUSTRIAL WATER POLLUTION PROBLEM,
Albert E. Grady.
New Eng L Rev, Vol 5, p 61-27, 1969. 34 ref.

Descriptors: *Water pollution, *Pollution abatement, *Industrial wastes, *Water pollution control, Water pollution treatment, Effluents, Riparian rights, Public health, Taxes, Costs, Operating costs, Industrial wastes, Water quality, Standards, Water Quality Act, Legislation, State governments, Federal government, Legal aspects, Political aspects, Administrative agencies, Industries.
Identifiers: *Effluent charges.

Pollution has become an extremely serious and perplexing problem in the United States. The major contributors to pollution are government and industry. As industry established itself in the last century, pollution was actually encouraged by the creation of a right to reasonable pollution under riparian law and by the balancing-of-equities doctrine. Courts can no longer act as the vehicle for controlling pollution; legislative action is the only feasible alternative. The basic question to be answered is who will pay for pollution abatement--taxpayers or industry. It is apparent that both will have to contribute to the cost of abatement. Tax incentives appeal to industry and can provide a method of inducing installation of abatement facilities. However, there is no way to insure the quality of the investment for the efficiency of its operations. A highly recommended method is for states to set stream quality standards and to place effluent charges upon any industrial wastes which exceed the predetermined permissible levels. All industries will thereby be made answerable for their pollution and will be treated equally and fairly. (Hubener-Florida)
W70-08803

THE USE OF DIGITAL SYSTEMS MODELING IN THE EVALUATION OF REGIONAL WATER QUALITY INVOLVING SINGLE OR MULTIPLE RELEASES,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
R. T. Jaske.
Battelle Memorial Institute, BNWL-SA-1372, August, 1967. 10 fig, 1 tab, 9 ref.

Descriptors: *Model studies, *Turbulent flow, *Computer programs, Theoretical analysis, Water temperature, On-site data collections, Mathematical models, Channel flow, Grand Coulee dam, Density currents, Columbia River, Weather data.
Identifiers: *Transport model, Bowen ratio, Interfacial mass exchange.

In 1963, a digital simulation model was started with the objective of modeling various streams. The major emphasis on the improved transport model was for it to be general enough for application to any turbulent stream. As a result, the development of a digital simulation system based on theoretical

channel flow has been successfully accomplished and used in a variety of cases involving widely divergent input variables. For example, river temperatures in existing systems have been successfully modeled to within 0.25C over a six month period. Moreover, the resulting transport model is suitable for preliminary studies of effluent dispersion for emergency planning or in cases where little or no actual field data exist. Even the Bowen ratio can be continuously varied and the results compared with field data as a means of determining the validity of related concepts. Comparison can readily be made among comparative mathematical models governing varying interfacial mass exchange expressions as a means of determining the relative error introduced or the degree of accuracy required for individual parametric measurements. A hypothetical example is shown for the Illinois River. (Osborne-Vanderbilt)
W70-08828

THERMAL LOADING IN DUNKIRK HARBOR,
State Univ. Coll., Fredonia, N.Y.
Ruth E. Braun, and John A. Jones.
Lake Erie Environmental Studies, Technical Report No. 5, April 1970. 12 p, 6 fig.

Descriptors: *Thermal pollution, *Water temperature, *Heat, Water circulation, Powerplants, Warm-water fishing, Seasonal, Surfaces, Volume, Harbors, Lake Erie, Winds, Eddies, Isotherms, Conductivity, Reservoir evaporation.
Identifiers: *Temperature anomalies, Thermistor, Relative humidity.

Thermal loading due to warmed effluents from a power plant located on Dunkirk harbor has been investigated over a 14-month period. Temperature anomalies of more than 3C were found to exist in the harbor year-round. Greatest anomalies occurred in March, smallest anomalies in April. The harbor basin was noted to be capable of dissipating the heat added by the power plant. Little effect could be found outside the confines of the harbor. No serious detrimental effects due to thermal loading have been demonstrated. As far as the residents of Dunkirk are concerned, the heat which the power plant releases is more beneficial than harmful. Fishing is good year-round and boats can remain in the water over the winter. Since the harbor basin is capable of dissipating the added heat under present conditions, the ratio of heat added to the surface area or volume of the harbor is considered favorable. Any project which might change the size of circulation pattern in the basin should be carefully considered in light of the effects it might have on the characteristics of thermal dissipation of the harbor. (Osborne-Vanderbilt)
W70-08838

A WATER QUALITY MODEL OF CHLORIDES IN GREAT LAKES,
Manhattan Coll., Bronx, N.Y. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02K.
W70-08931

MODEL FOR CAPTURE OF RADIOACTIVITY BY PRECIPITATION,
Institute of Experimental Meteorology, Obninsk (USSR).
For primary bibliographic entry see Field 02B.
W70-08941

DISPOSAL OF SOLID AND SEMI-SOLID TOXIC WASTES,
Hertfordshire County Council (England).
J. L. Stringer.
Water Pollution Control, Vol 69, No 3, p 321-333, 1970. 3 ref

Descriptors: *Disposal, *Industrial wastes, *Solid wastes, *Toxicity, Liquid wastes

A discussion is given of refuse disposal methods in Hertfordshire, an area rich in sand and gravel operations. Methods of disposal include: pretreatment, dumping, incineration, salvage, and sea disposal. Many conflicting interests are involved in the disposal of toxic wastes, including: industry, waste removal contractors, river authorities and water undertakings, sewerage authorities, and public health and planning interests. Most disposal problems have arisen from the handling and dumping of putrescible materials. Depending on the geological conditions and the nearness of wells, the water interests often require protection of the underlying chalk with varying thicknesses of inert material. Risks from dumping of toxic materials vary with the location of the site in relation to wells, the nature of the underground strata and the character of the material. Natural or physical processes reduce the risk, such as when an acid waste is disposed of on chalk. Ion exchange operates in some subsoils, notably clay, while bacteria break down complex molecules and change the chemical properties of some substances. (Aguirre-Texas)
W70-08956

PHYSIOGRAPHY-LAND USE INTERACTIONS IN WATERSHED MANAGEMENT,
British Columbia Univ., Vancouver. Dept. of Forestry.
H. Olav Slaymaker, and Walter W. Jeffrey.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 170-181, 1969. 60 ref.

Descriptors: *Geomorphology, *Land management, *Water yield improvement, *Water quality control, Land use, Topography, Drainage patterns (Geologic), Sediment yield, Overland flow, Watershed management, Erosion, Infiltration, Forest management.
Identifiers: Physiography management.

A distinctive characteristic of some physiographic factors and all land use practices which influence hydrologic response is that they can be manipulated over relatively short time periods. Moreover, physiographic and land use parameters interact so as to produce distinctive hydrologic responses. Those physiographic parameters which cannot be manipulated over the short time period are also of interest insofar as they represent the end-product of long-continued operation of physiography-land use interactions. Length of overland flow, drainage density and hydraulic geometry are variables which can be manipulated; relief ratio, maximum valley side slope and drainage basin area are examples of significant geomorphic parameters which are effectively impossible to manipulate. The parts played by surface resistance to erosion and infiltration capacity in a variety of physiography-land use situations are considered. (See also W70-08597)
W70-08989

5C. Effects of Pollution

ADVANCES IN WATER POLLUTION RESEARCH.
For primary bibliographic entry see Field 05G.
W70-08627

THE PROBLEM OF THE CYTOTOXICITY OF WATER,
Paris Health Lab. (France).
L. Coin, C. Hannoun, and J. C. Trimoreau.
In: Advances in Water Pollution Research, Proceeding 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 95-101, 1969. 7 p, 2 fig, 3 tab.

Descriptors: *Water pollution effects, *Cytological studies, *Viruses, Laboratory tests, Surface waters, Groundwater, Effluents, Foreign research.
Identifiers: *Phenol index, *Inhibitory minim
dose, Paris (France).

In the course of attempts to isolate viruses syst
matically from water, secondary toxic phenome
were observed showing that water can manife
certain inhibitory properties with regard to the te
cells cultured for virological practice. After n
merous trials with water of different natures co
ing from different areas, the following was dete
mined: a phenol index, the value of which approx
mates that of the taste thresholds; and a minimal i
hibitory dose for a given cellular population whi
leads to characterization of the specific features
the organic matter of the water sample. The
determinations may be considered for inclusio
with tests designed to expalin the secondary tox
phenomena. (Woodard-USGS)
W70-08634

**FACTORS INFLUENCING PHOSPHATE US
BY ALGAE,**
Minnesota Univ., Minneapolis. Limnologic
Research Center.
Joseph Shapiro, William Chamberlain, and Judith
Barrett.
Partially supported by FWQA research grant. I
Advances in Water Pollution Research, Proceedi
4th International Conference on Water Pollutio
Research, held in Prague, Czechoslovakia, Ap
21-25, 1969: London, Pergamon Press, Ltd, p 14
160, 1969. 12 p, 10 fig, 3 tab, 13 ref.

Descriptors: *Eutrophication, *Lakes, *Alga
*Growth rates, *Phosphates, Laboratory tes
Minnesota, Nutrients, Water pollution effects.
Identifiers: *Microcystis aeruginosa, *Lake water

Microcystis aeruginosa from lakes in Minnesot
was used to show the relationships of phosphorus
algae growth in natural water systems. The rap
rate of absorption of phosphate by algae suspende
in lake water is largely due to the inorganic salts
the water and not to an organic factor. (Woodar
USGS)
W70-08637

**AVOIDANCE REACTIONS OF SALMONI
FISH TO REPRESENTATIVE POLLUTANTS,**
Fisheries Research Board of Canada, St. Andrew
(New Brunswick). Biological Station.
John B. Sprague, and Donald E. Drury.
In: Advances in Water Pollution Researc
Proceedings 4th International Conference of Wat
Pollution Research, held in Pragu
Czechoslovakia, April 21-25, 1969: London, Pe
gamon Press, Ltd, p 169-179, 1969. 11 p, 5 fig, 2
ref.

Descriptors: *Fish, *Water pollution effects, *Po
lutants, *Laboratory tests, Atlantic salmon, Rai
bow trout, Detergents, Phenols, Chlorine, Pu
wastes, Foreign research.
Identifiers: *Avoidance reactions, Canada.

Studies to determine whether there is a general pa
tern of spontaneous avoidance reactions by fish
pollutants are described. The laboratory findin
are related to field situations to predict behavior
fish if their natural habitat were affected by the
pollutants. Rainbow trout and Atlantic salmo
were subjected to clean water and to vario
sublethal concentrations of ABS detergent, phen
chlorine and pulp mill effluent. Graphs show th
percent of time the fish avoided or preferred sol
tions of clean water and different concentrations
the pollutants. (Woodard-USGS)
W70-08638

**DETERMINATION OF THE POLLUTIONA
EFFECT OF SURFACE RUNOFF,**
Ministry of Land Reclamation and Wat
Economics, Minsk (USSR). Inst. of Wat
Problems.
N. A. Pravoshinsky, and P. D. Gatillo.

In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 187-195, 1969. 9 p, 3 fig, 1 tab, 27 ref.

Descriptors: *Water pollution sources, *Cities, *Storm runoff, *Surface runoff, *Urbanization, Water pollution effects, Biochemical oxygen demand, Dissolved solids, Bacteria, Oil wastes, Foreign research.
Identifiers: *USSR, Minsk.

Pollution by urban surface runoff depends on the intensity of movement of street traffic and use by pedestrians, type of cover of catchment, duration and intensity of rain, standards of water discharge of watering and washing, the amount of dust deposition, the elevation of the catchment water basin, duration of preceding dry weather period, quality and technology of town cleaning, and the means of dust control. Data were compiled from samples collected in the well-built-up districts of Minsk, USSR remote from big industrial interprises and Soligorsk, a rapidly developing town. The value of 5-day BOD was used as a primary index of runoff pollution. In addition, the concentrations of suspended solids, chlorides, oil-products, and bacterial pollution were determined. (Woodard-USGS)
W70-08639

THE INFLUENCE OF SUSPENDED SOLIDS ON THE RATE OF OXYGEN TRANSFER IN AQUEOUS SOLUTIONS,
Technische Hogeschool, Delft (Netherlands). Dept. of Sanitary Engineering.
G. T. M. Van der Kroon.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, Apr 21-25, 1969: London, Pergamon Press, Ltd, p 219-229, 1969. 11 p, 11 ref, append.

Descriptors: *Dissolved oxygen, *Oxygenation, *Suspension, *Aqueous solutions, Suspended load, Oxygen, Water pollution, Test procedures, Laboratory equipment, Equations, Reaeration, Oxygen demand, Water pollution effects.
Identifiers: Oxygen transfer.

An experimental study was made of the rate of oxygen transfer in artificial mixed liquor samples from a bench scale pilot plant, as well as in suspensions of aluminium hydroxide. Oxygen, absorbed from dispersed air, was continuously replenished by injection of pure oxygen gas into the measuring system. Oxygen sensors were used to determine D. O. -contents of the liquid phase and partial oxygen pressures in the gaseous phase. Because research was primarily on the role of flocculant particles, different operating conditions including rate of gas flow, size of the dispersion device and temperature were held constant. The drop of the oxygen saturation value in a mixed liquor and a suspension of aluminium hydroxide is less than 5%. The rate of oxygen transfer in both suspensions depends upon the concentration of the suspended solids, and decreases when the suspended solids concentration increases. The rate of drop appears to depend on the quality of the suspended flocs. The rate of oxygen transfer in a mixed liquor is independent of the rate of respiration. (Woodard-USGS)
W70-08645

PRELIMINARY OBSERVATIONS ON RESPONSE OF YOUNG ONES OF CHINESE CARPS TO VARIOUS PHYSICO-CHEMICAL FACTORS OF WATER,
Fisheries Research Station, Cuttack (India).
S. B. Singh, S. C. Banerjee, and P. C. Chakrabarti.
Proceedings of the National Academy of Sciences, India, Vol 37 (B), No 111, p 320-324, 1967. 1 tab, 4 ref.

Descriptors: *Carp, Bioassay, *Fish stocking, Fish management, Fish establishment, *Fish behavior, Fish physiology, Water temperature, Mortality, Fishkill, *Water quality, Salinity, Turbidity, Hydrogen ion concentration, Laboratory experiments, Dissolved oxygen, Alkalinity, Ammonia, Sulfides, Water chemistry.
Identifiers: India, *Chinese grass carp, *Silver carp, *Tolerance.

Chinese grass carp and silver carp are being introduced into various parts of India. Laboratory experiments were conducted to study the response and reaction of the young chinese and silver carps to wide fluctuations in water temperature, turbidity, pH, dissolved oxygen, total alkalinity, salinity, free ammonia, chlorine, and sulfide which may occur in the different habitats where the fish were introduced. Tolerance limits for both carp species to the water quality parameters are given. The authors concluded that the grass carp were able to withstand slightly greater fluctuations than were the silver carp. (Sjolseth-Washington)
W70-08646

COHO SALMON MORTALITY AND DDT IN LAKE MICHIGAN,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
Howard E. Johnson, and Charles Pecor.
Thirty-Fourth North American Wildlife Conference Transactions, p 159-166, 1969. 2 tab, 19 ref. FWPCA Training Grant 5T1-WP-109.

Descriptors: *DDT, Chlorinated hydrocarbon pesticides, Pesticide toxicity, Pesticide residues, *Mortality, *Lake Michigan, Eggs, Lake Superior.
Identifiers: *Coho salmon, DDD, DDE, *Fry mortality.

Investigations were initiated in 1967 to identify and quantity pesticide residues in coho salmon eggs in Lake Michigan and to determine their effects on the hatching fry. DDT concentrations in Lake Michigan coho salmon eggs were three to five times higher than in those from Lake Superior and approximately 60 times higher than in eggs from Oregon. A mortality syndrome, characterized by an abrupt appearance of symptoms during the last stage of yolk sac absorption, was observed in all groups from Lake Michigan. No evidence of the symptoms was observed in Lake Superior and Oregon groups. Higher residues in the eggs of Lake Michigan salmon were, in general, associated with higher mortalities of the fry. DDT concentrations in the last fractions of yolk present in the gut when symptoms first appeared were 6 to 12 times higher than in the body tissues. The absorption of relatively high concentrations of DDT from the gut is suggested as an explanation for the mortality of the coho salmon fry. (Sjolseth-Washington)
W70-08647

EXPERIMENTAL USE OF CHLORDANE IN FISHERY MANAGEMENT,
Bihar Univ., Buzaffarpur (India). Dept. of Zoology.
S. K. Konar.
The Progressive Fish-Culturist, Vol 30, No 2, p 96-99, 1968. 5 ref, 3 tab.

Descriptors: *Fish management, Fish control agents, Fish toxins, Pesticide toxicity, Chlorinated hydrocarbon pesticides, Aquatic insects, Catfishes, *Bioassays, *Lethal limit, Daphnia, Fish food organisms, Fish behavior, Phytoplankton, Zooplankton, Fish physiology, Resistance.
Identifiers: *Chlordane, Labeo rohita, Residual toxicity.

Chlordane is highly toxic but not selective to fish and insects. The LD (0), LD (50), and LD (100) of chlordane to 9 species of freshwater fish and to 9 species of aquatic insects are given. Aquatic insects were more resistant than the fish. Generally, the fishes seemed to be more susceptible to the chlordane than most of the zooplankters. The prolonged residual toxicity of chlordane makes it unsuitable for fishery management. The author feels that on the basis of the present results, that chlordane should not be used in pest-control operations in fields adjacent to fishery reservoirs. (Sjolseth-Washington)
W70-08648

DDVP AS A SELECTIVE TOXICANT FOR THE CONTROL OF FISHES AND INSECTS,
Bihar Univ., Buzaffarpur (India). Dept. of Zoology.
U. S. Srivastava, and S. K. Konar.
The Progressive Fish-Culturist, Vol 28, No 4, p 235-238, 1966. 4 ref, 3 tab.

Descriptors: Carp, Pesticide toxicity, *Bioassay, Mortality, Fishkill, Aquatic insects, Lethal limit, Resistance, Fish management, *Fish control agents, Eels, Fish toxins, Predation, Fish farming, Insect control.
Identifiers: *DDVP, *Selective toxicant, *Residual toxicity.

The nonpersistent insecticide DDVP is a selective toxicant that shows promise as a control for predaceous insects and fishes and for competitor fishes in pond culture of carp, Labeo rohita, in India. The authors find DDVP toxic to fish; but the lethal doses for all the 11 fish species tested are much higher than the lethal doses for insects (6 species tested). The residual toxicity of 20 ppm DDVP is about 3 weeks at a temperature range of 44 deg to 77 deg F without the use of any detoxifying substance. This seems to be much shorter than the residual toxicity of most other chemicals tried. (Sjolseth-Washington)
W70-08649

TETRACHLORO-o-BENZOQUINONE AS A COMPONENT IN BLEACHED KRAFT CHLORINATION EFFLUENT TOXIC TO YOUNG SALMON,
Ontario Research Foundation, Toronto; and Fraser Companies Ltd., Edmundston (New Brunswick).
B. S. Das, S. G. Reid, J. L. Betts, and K. Patrick.
J Fish Res Bd Canada, Vol 26, p 3055-3067, 1969. 2 tab, 2 fig, 19 ref.

Descriptors: *Atlantic salmon, *Bioassay, *Pulp wastes, Stability, Water pollution effects, *Toxicity, Fish toxins, Waste identification, Analytical techniques, Mortality, Chemical analysis.
Identifiers: *Tetrachloro-benzoquinone, *Bleached Kraft effluent, Tetrachlorocatechol.

Evidence is given that tetrachloro-benzoquinone is involved in the toxicity of bleached kraft chlorination effluent (BKCE) to young Atlantic salmon, Salmo salar. The main experimental support was isolation of tetrachlorocatechol from whole BKCE and from a BKCE fraction toxic to salmon, after reduction of both with sodium borohydride. Tetrachloro-o-benzoquinone was shown to be toxic to salmon at low concentrations. Instability of the toxic component in BKCE and substantial loss of toxicity upon treatment of BKCE with sulfur dioxide agreed with the properties of tetrachloro-o-benzoquinone in water solution. (Sjolseth-Washington)
W70-08650

HEAT TOLERANCE OF ALBINO VS. NORMAL CHANNEL CATFISH ICTALURUS PUNCTATUS,
Louisiana State Univ., Baton Rouge. Dept. of Forestry and Wildlife Management.
Kenneth O. Allen.
Proceedings of the 22nd Annual Conference of the Southeastern Association of Game and Fish Commissioners, 1968, 1970. 4 p, 1 tab, 12 ref.

Descriptors: Catfishes, Channel catfish, Acclimatization, *Heat resistance, Heated water, Thermal pollution, *Thermal stress, Resistance, Pigments, Fishkill, Mortality, Water pollution effects, Fish physiology.

Identifiers: *Ictalurus punctatus, *Thermal tolerance survival, *Lethal effects, Albino catfish, *Pigmentation.

Two lots of the Arkansas strain of channel catfish, Ictalurus punctatus, containing both albino and normal fish, were acclimated in the laboratory at a constant temperature of 30.0 deg C. Samples of albino and normal fish were exposed to a lethal temperature of 39.0 deg C. The albinos from both lots had the highest mean survival time, but the differences were not statistically significant. (Sjolseth-Washington)
W70-08651

METABOLISM OF LINDANE BY UNICELLULAR ALGAE,
State University Coll., Buffalo, N.Y. Great Lakes Lab.
Robert A. Sweeney.
Proceedings of the 12th Conference on Great Lakes Research, p 98-102, 1969. 3 fig, 18 ref. USPHS Grant IT-WP-3901-A.

Descriptors: Pesticide residues, Algae, Great Lakes, Metabolism, *Chlorella, *Chlamydomonas Laboratory tests, Gas chromatography, Degradation, Water pollution effects, Aquatic environment, Chlorinated hydrocarbon pesticides, Plant physiology.
Identifiers: *Lindane, *Algae metabolism, Detoxification, Lindane metabolism.

Lindane is an insecticide that has been detected in the Great Lakes Basin. The metabolism of this pesticide by Chlorella vulgaris and Chlamydomonas reinhardtii in axenic culture was ascertained. Each species was cultured in a solution initially containing 4.5, 2.3, or 0.0 ppm lindane. Using chromatographic techniques, a marked decrease in the lindane concentration with time was noted. A substance was observed in extractions of the solutions containing algae and lindane which was not present in extracts from either algae-free cultures containing lindane or from algae in a lindane-free medium. This substance was identified as 1, 3, 4, 5, 6 --pentachloro-cyclohex-l-ene, a non-toxic lindane metabolite. This indicated that Chlorella and Chlamydomonas can metabolize lindane. It also may explain in part the relatively low concentration of this pesticide in the Great Lakes. (Sjolseth-Washington)
W70-08652

PHOSPHATES IN PEORIA LAKE: A QUANTITATIVE AND QUALITATIVE EVALUATION OF A NUTRIENT IN NATURAL WATERS,
Illinois State Water Survey, Peoria. Water Quality Section.
For primary bibliographic entry see Field 02H.
W70-08653

RELATIONSHIPS BETWEEN BACTERIA AND PHYTOPLANKTON,
Byelorussian State Univ., Minsk (USSR). Dept. of Invertebrate Zoology.
For primary bibliographic entry see Field 02H.
W70-08654

SUCCESSION IN ALGAL MAT COMMUNITIES AT THREE NUTRIENT LEVELS,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
Jerry L. Wilhm, and Joseph Long.
Ecology, Vol 50, No 4, p 645-652, 1969. 9 fig, 5 tab, 15 ref.

Descriptors: *Biological communities, *Succession, *Nutrients, Phosphates, Nitrates, Biomass, Pigments, Productivity, Respiration, Ecosystems, Chlorophyll, Chemical properties, Hydrogen ion concentration, Carbon dioxide, Scenedesmus, Bacteria, Protozoa, Rotifers.
Identifiers: *Algal mats, Mougeotia, Anabaena, Oscillatoria, Phormidium, Production-respiration ratio, Production-biomass ratio, Production-chlorophyll ratio.

Ecosystems tend to evolve to a steady state in which net primary production and respiration are balanced and the quantity of biomass constant. It is thought that during succession net primary production decreases at a greater rate than biomass increases and that the ratio between these two variables may be used as indicator of the succession state. Effect of three different levels of phosphates and nitrates on temporal variation of structural and functional parameters was studied in algal mat communities in microcosms, using 1 liter of farm pond water. Most common producers were Mougeotia, Phormidium, and Anabaena. Microcosms receiving the largest input of nutrients were highest in biomass and pigments, but no greater in net production and respiration than microecosystems receiving an intermediate level of nutrients. These four variables remained low in systems receiving the lowest nutrient levels. The ratio of production to respiration approached unity at all nutrient levels. Production/biomass and production/chlorophyll, that is, assimilation number ratios, generally decreased with time and leveled off at all nutrient levels. No effects on the pigment diversity ratio, D-430/D-665 attributable to nutrients were observed. (Jones-Wisconsin)
W70-08657

EFFECTS OF ORGANIC WASTES ON RIVERS,
Water Pollution Research Lab., Stevenage (England).
E. J. C. Curtis, and D. W. Harrington.
Process Biochemistry, Vol 5, No 4, p 44-46, 62, 1970. 3 fig, 3 tab, 14 ref.

Descriptors: *Water pollution effects, *Rivers, *Organic wastes, Effluents, Biological treatment, Biochemical oxygen demand, Bioindicators, Sewage bacteria, Biodegradation, Microorganisms, Water pollution sources, Benthic fauna, Water pollution control, Sewage effluents, Industrial wastes, Slime, Dissolved oxygen.
Identifiers: Filamentous microorganisms, Sewage fungus, Soluble organics, Biotic index, Saprobien system, Portable channels, England.

Effluents containing excessive amounts of organic material produce unfavorable conditions for organisms by direct toxicity or excessive growth of heterotrophic organisms depleting oxygen supplies. Diversity from normal water communities indicates severity of pollution. Organic pollution produces definable zones of pollution severity below effluent discharge. Inorganic nutrients support growth just before recovery zone. Normal sanitary analysis should be performed in addition to biological indicator systems since biological community structure depends on several factors. Filamentous or colonial microorganisms form attached slimes called 'sewage fungus', stimulated by a variety of organic effluents. They are major causes of oxygen depletion and are aesthetically objectionable. Slime production potential of organic effluent is most easily determined by measuring soluble organic content if effluent contains all readily biodegradeable organic compounds. Inorganic nutrients are unlikely to limit slime growth. Removal of organic biodegradable matter from effluents is best done by conventional biological treatment processes. Partial removal has no effect on slime growth. Intermittent discharge of organic effluent controls slime growth by preventing slime build-up. (Bannerman-Wisconsin)
W70-08665

WATER POLLUTION IN REMOTE RECREATIONAL AREAS,
Forest Service (USDA), Duluth, Minn. Superior National Forest.
Michael A. Barton.
Journal of Soil and Water Conservation, Vol 24, No 4, p 132-134, July-August 1969. 4 photo, 1 tab, 7 ref.

Descriptors: *Water pollution, *Recreatio Recreation facilities, Population, Water qualit Monitoring, Nutrients.
Identifiers: Visitor inputs, Natural inputs.

Pollution and/or enrichment of waters in remo recreational areas has generally not proceeded the same extent that it has in more heavily popu lated areas. The lack of concentrated populatio and industries space these areas from the severit of the problem as it exists in urban areas. The sma amounts of pollutants and/or nutrients are muc more noticeable in this high quality water than waters already receiving such inputs. Continue population expansion, increased leisure time an affluence will require that wilderness areas absor greater use. These areas must be protected if the are to survive as an ecological entity. Using stan dards of clean water normally considered ap propriate in water quality control programs, wi derness waters could be degraded significantly be fore uses other than recreation would be damaged Little consideration is given to nutrient enrichmen in formulating standards. Greater emphasis must b accorded to nutrients, and the aquatic growth the produce and the impact of nutrients on aesthet qualities. (Loeb-Rutgers)
W70-08694

THERMAL POLLUTION: THE EFFECT O THE PROBLEM,
La Salle Coll., Philadelphia, Pa.
Charles B. Wurtz.
In: Environmental Problems, edited by Billy Ra Wilson, Philadelphia, L. B. Lippincott Co. 1968, 131-145.

Descriptors: *Thermal pollution, *Pollution con trol, Costs, Temperature changes, Trout, Fishing Cooling, Hydroelectric power, Rivers, Water qual ty, Dissolved oxygen, Metabolism, Correlatio analysis, Productivity, Economic justificatio Benefits, Water law, Investment, Fisheries
Identifiers: *Delaware River, *Metabolic rates.

This paper discusses the effects of artificially in creased water temperatures. One of the greates impediments to controlling thermal pollution is th cost involved. The author discusses the direct rela tion between cost and water quality and gives som examples of the difficulty of deciding which invest ment to make. The paper also discusses the biologi cal effects of increased water temperature. Th author disputes some of the current thinking an analyzes the effect of thermal pollution on dis solved oxygen, and the metabolic rates of living or ganisms. Heat added to the water will increase th productivity of that water, and, in the long run bring higher fish yields. The author concludes wit an analysis of the costs of controlling water pollu tion and argues for realistic goals in control regula tions. (Murphy-Rutgers)
W70-08719

POLLUTION CONTROL: WHY HAS IT FAILED,
Arnold W. Reitze.
American Bar Association Journal, Vol 55, Oct 1969, p 923-927.

Descriptors: *Water pollution effects, *Pollutio abatement, *Air pollution, *Water pollution con trol, Pollutants, Water pollution, Water pollutio sources, Wastes, Soil condemnation, Thermal pol lution, Air pollution effects, Effects, Public health Agricultural chemicals, Fertilizers, Detergents Domestic wastes, Mine wastes, Coordination Federal government, State governments, Adminis trative agencies, Environment, Legislation, Indus tries.

Examining problems that arise with increasing en vironmental pollution, this article contends that to curtail an impending environmental crisis there must be an increasing concern at all levels o society. Various causes, sources, and effects of pol lution are noted. The author calls for three types o

control methods to check pollution. First, there must be a development of public hostility towards pollution. Second, there must be established legal controls and sanctions and a concentrated and centralized effort by federal and state governments to approach the pollution problem. The effectiveness of various agencies are noted, especially the Federal Water Pollution Control Administration; nevertheless, a more centralized effort in the overall area of pollution is called for. Third, the article suggests that economic sacrifice is essential to the fight against pollution. The author notes that any answer to the pollution problem will be costly to government, industry, business, and individuals, but the burden must be accepted. (Snow-Florida)
W70-08812

TOLERANCE OF MYSIS RELICTA TO THERMAL SHOCK AND LIGHT,
Federal Water Pollution Control Administration, Duluth, Minn.
Wesley E. Smith.
Transactions of the American Fisheries Society, Vol 99, No 2, p 418-422, April 1970. 7 fig, 9 ref.

Descriptors: *Water temperature, *Heat resistance, *Ambient light, Resistance, Aquatic animals, Bioassay, Lethal limit, Mortality, Acclimatization, Light, Temperature, Thermal stress.
Identifiers: *Mysis relicta, Thermal shock.

Tests were conducted to determine the thermal tolerance and effects of laboratory illumination on survival of Mysis relicta. Mysids were affected adversely by heat stress when temperatures rose about 10C. When acclimated to a temperature of 7.5C, this species has 96-hour median tolerance limits of 16 to 16.5C. Percent mortality was essentially the same when the animals were subjected immediately to test temperatures, as when temperatures were raised gradually from acclimation temperature over a period of 5 hours. When acclimated to a temperature of 4.5C and then subjected to temperature elevations of 1, 2.5, and 5C per day, 50% of the animals died at 16C in 16 days, 18C in 6 days, and 16C in 4 days, respectively. Mysis relicta is an organism requiring considerable time for effective acclimation. Mysids were intolerant of exposure to normal laboratory illumination. The species lived satisfactorily in light of 10 hours a day for 2 weeks, but this period was followed by a steady mortality of about 8% of the original population per week. (Hsieh-Vanderbilt)
W70-08824

THE CALEFACTION OF A RIVER,
Connecticut Water Resources Commission.
Daniel Merriman.
Scientific American, Vol. 222, No. 5, p 42-52, 10, 148, May 1970. 7 fig, 32 ref.

Descriptors: *Thermal pollution, *Nuclear powerplants, Cooling water, Thermal stratification, Benthic fauna, Fish population, Fish reproduction.
Identifiers: *Calefaction, Thermal block.

An interim report is presented on a survey (1965-1972) on the thermal disturbances of the Connecticut River by heated water from the Connecticut Yankee Haddam Neck's Nuclear powerplant and its biological effects. The location of the water with a higher temperature than normal due to the heated water discharge was given for the seasonal low flow of the river when the river water temperature was at its seasonal high. No thermal block was found. The survey data on the river biology indicate that there has been no significant deleterious effect on the biology of the river though there have been changes in the flora near the plant, in the bottom fauna at the point of effluent discharge and in the condition of the bottom habitat near the plant intake. No significant influence on the river's fish population was found. The catfish entering the cooling water discharge-canal do not fare as well as in the river. (Rietveld-Vanderbilt)
W70-08825

THE ECOLOGY OF FLOWING WATERS IN RELATION TO MANAGEMENT,
Waterloo Univ. (Ontario).
H. B. N. Hynes.
Journal of Water Pollution Control Federation, Vol. 42, No. 3, p 418-424, March 1970. 10 ref.

Descriptors: *Ecology, *Temperature, *Biology, *Fish, *Water quality control, Fungi, Watershed management, Ecosystems, Streams.

Four aspects of the ecology of running water are discussed in relation to the management of watersheds. They are temperature, substratum, the sources of food for invertebrates, and the breeding requirements of fish. It is shown how each may be altered almost inadvertently by man with far-reaching biological effects. These may be deleterious or desirable, but often they are unanticipated by nonbiologists, and even the ecologist cannot claim that he will not meet surprises. A plea is made, therefore, for greater ecological education of watershed managers and much more interdisciplinary consultation in the planning of management programs. We should develop an appreciation of the likely biological consequences of our action and included in our value judgments. (Rietveld-Vanderbilt)
W70-08826

TIME AND EXTENT OF A FLOW REVERSAL IN THE LOWER COLUMBIA RIVER,
Bureau of Commercial Fisheries, Seattle, Wash.
For primary bibliographic entry see Field 02L.
W70-08831

THE RESPONSES OF YOUNG AMERICAN SHAD TO RAPID TEMPERATURE CHANGES,
Essex Marine Lab., Conn.
Sanford A. Moss.
Transaction of the American Fisheries Society, Vol 99, No 2, p 381-384, April 1970. 1 fig, 1 tab, 6 ref.

Descriptors: *Temperature, *Fish behavior, *Migration pattern, *Heated water, Lethal limit, Nuclear powerplants, Cooling water, Fish kill, Thermal pollution, Thermal powerplants.
Identifiers: Shad.

Preliminary experiments indicated that young American shad (Alosa sapidissima) experience rapid mortality when temperatures are quickly raised from an ambient temperature of 24 to 28C up to 32.5C. Temperature increases of this magnitude (Delta T = 5 to 9C) are within the range predicted for portions of the Connecticut River that are affected by the Connecticut Yankee Atomic Power Company cooling water discharge. This study is to learn how young shad behave upon encountering rapidly changing temperatures. Captive juvenile American shad avoided rapid temperature increases of about 4C above acclimatization temperatures in an experimental tank. Responses to rapid temperature changes of about 1.0C were not consistent and did not result in demonstrable avoidances. Young shad are capable of avoiding potentially lethal temperature changes. (Osborne-Vanderbilt)
W70-08833

HEAT AS A POLLUTANT,
General Electric Co., Richland, Wash.
Robert T. Jaske.
Oregon State Univ. Water Resources. Research Institute Water Quality Control Seminar Proceedings, Session 7, p 61-82, November 1964. 10 fig.

Descriptors: *Thermal pollution, *Temperature, Hydrogen ion concentration, Nutrients, Algae, Fish, Stratification, Flocculation, Turbines, Economic efficiency, Heat budget, Social aspects.

The effects of increased temperature on pH, nutrients, algae, taste, and fish are discussed. The advantages and disadvantages of stratification, flocculation, and other variations in the fluid mechanics of streams are considered. A specific example of a typical heat-producing industrial process of a turbine generator plant is examined. The efficiency and the overall plant economy is determined for varying temperatures of the effluent. Problems arising from stream size and the erection of dams and reservoirs are mentioned. Three primary concerns of further research include: (1) improved attention to heat budgets and mathematical treatment of air-water transport phenomena; (2) closer identification of the specific changes associated with the temperature parameter; and (3) improved standardization and methods of economic analysis for identification of the significant economic factors involved. (Osborne-Vanderbilt)
W70-08834

THE EFFECTS OF ELEVATED TEMPERATURE UPON AQUATIC INVERTEBRATES-A REVIEW OF LITERATURE RELATING TO FRESH WATER AND MARINE INVERTEBRATES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography; and John Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering Science.
Loren D. Jensen, Robert M. Davies, Arthur S. Brooks, and Caldwell D. Meyers.
Johns Hopkins Univ., Cooling Water Studies, Report No 4, 1969. 232 p, 384 ref, 14 fig, 6 tab.

Descriptors: *Aquatic environment, *Invertebrates, *Temperature, *Thermal stress, *Thermal pollution, Amphipoda, Aquatic insects, Commercial shellfish, Copepods, Crayfish, Crabs, Crustaceans, Insects, Isopods, Lobsters, Mollusks, Mussels, Oysters, Shrimp, Snails, Worms, Aquatic animals, Heated water, Estuaries, Marine animals, Brackish water, Heat resistance, Cold resistance, Fresh water.
Identifiers: Poikilotherms.

Literature directly concerning the effect of elevated temperatures upon both freshwater and marine invertebrates has been reviewed. The review has been limited to major invertebrate groups and does not, because of the lack of published data in some areas, include a uniform treatment of all the groups. The review was written as a source of information for the non-professional biologist. There are three sections. The first introduces the role of temperature in the biology-ecology of the aquatic ecosystem and the effect of temperature on the environment. Section two is an introduction to major invertebrate groups, their morphology and life history, and a review of the published information on the effect of elevated temperatures on the whole animal and the effect on reporduction and development. The third section presents conclusions and interpretations drawn from the published data discussed in sections one and two. (Speakman-Vanderbilt)
W70-08835

RESEARCH IN THERMAL POLLUTION CONTROL,
American Water Resources Association, Urbana, Ill.
Frank H. Rainwater.
Proceedings 4th American Water Resources Conference, Nov. 18-22, 1968. American Water Resources Assn. Urbana, Ill., Ill., 1969. p 140-145.

Descriptors: *Thermal pollution, *Water temperature, Evaporation, Cities, Heat transfer, Mathematical models, Meteorological data, Aquatic life, Cooling, Balance of nature, Economic efficiency.
Identifiers: *Water heat, AEC.

Until recently, Americans have not been aware of thermal pollution and its consequences. Since decisions made today will determine what powerplants go on line six or seven years from now, research is of prime importance. Short-term goals for this research should include: (1) a better understanding of the physics of heat input, transport and dissipation in water resources along with non-empirical,

stochastic, thermal mathematical modeling; (2) a better knowledge of the effects of aquatic biota and identification of species having special ecological and economic importance; and (3) increased thermal efficiency and water consumption of cooling devices. Long-term goals should include research results leading to practical power generation by advanced techniques, energy cycles that reject substantially less heat to the environment, and a management approach involving the whole concept of energy utilization. However, the ultimate success in thermal pollution control depends on the regulatory agency, the polluter, and the user of water doing his part, research being done on priority items, and emphasis focused on how to prevent and abate thermal pollution - not on how to justify it. (Osborne-Vanderbilt)
W70-08840

WATER QUALITY AND THE MIGRATION OF FALL SALMON IN THE LOWER WILLAMETTE RIVER,
Oregon Fish Commission, Astoria.
Roy E. Sams, and Kelly R. Conover.
Final Report, May, 1969. 58 p, 23 fig, 22 tab.

Descriptors: Water pollution effects, Chinook salmon, *Water quality, *Water temperature, *Fish migration, *Dissolved oxygen, Water levels, Oregon, Columbia River, Time of Concentration, Streamflow, Impaired water quality, Fish management, Fish barriers, Anadromous fish.
Identifiers: Coho salmon, *Willamette River.

Water quality and salmon migration data for the lower Willamette River were collected and analyzed to determine if water quality affected the migration of salmon. Some of the more important conclusions are: (1) Columbia River Coho salmon occur over a wide period of time, usually peaking in late October; (2) Chinook begin in early September; (3) Initial passage of chinook and coho over Willamette Falls was not preceded by a significant increase or decrease in streamflow; (4) At times low tides may have restricted passage over the falls; (5) 73 deg F water in the Willamette has not blocked fish from entering the river and (6) no salmon were observed passing over Willamette Falls until the D.O. level rose to 5 ppm or above. (Sjolseth-Washington)
W70-08920

SEAFOODS PROCESSING: POLLUTION PROBLEMS AND GUIDELINES FOR IMPROVEMENT,
Oregon State Univ., Corvallis. Dept. of Food Science and Technology.
M. R. Soderquist, K. J. Williamson, and G. I. Blanton.
Proceedings of the National Symposium on Food Processing Wastes, Apr 6 - 8, 1970, Portland, Oregon. p 189-225, 65 ref, 8 tab, 7 fig. FWQA Grant 12060 ECF.

Descriptors: *Water pollution sources, Water pollution effects, *Water pollution control, Pollution abatement, Marine fisheries, Herrings, *Waste disposal, Research and development, Bottom fish, Crabs, Salmon, Canneries, Commercial fishing, Shrimp, Byproducts, On-site investigations, *Waste water treatment, Industrial wastes.
Identifiers: Menhaden, *Seafood processing, Tuna processing, Waste characteristics, Canning, Byproduct recovery.

The processing is discussed of the major United States seafoods species, the resultant waste water strengths and flows, solid wastes magnitudes, current treatment and by-product recovery methods, and current and recommended research in water pollution abatement. The paper was based on a comprehensive literature review and extensive on-site investigations of current research, processing, and treatment activities in the major seafoods centers of the U. S. (Sjolseth-Washington)
W70-08921

THE EFFECT OF TEMPERATURE ON THE RATE OF DEVELOPMENT AND SURVIVAL OF ALEWIFE EGGS AND LARVAE,
Bureau of Commercial Fisheries, Ann Arbor, Mich. Great Lakes Fishery Lab.
Thomas A. Edsall.
Trans Amer Fish Soc, Vol 99, No 2, p 376-380, 1970. 12 ref, 4 fig.

Descriptors: Lake Michigan, *Water temperature, Water pollution effects, Mortality, Fishkill, Fish eggs, *Hatching, *Viability, Incubation, Larval growth stage.
Identifiers: *Alewives, Water temperature effects, Development rate, Survival, *Egg mortality, *Hatching success, *Incubation time.

Eggs from Lake Michigan alewives (Alosa pseudoharengus) were incubated at 79 different temperatures from 42.1 to 87.0 F. Hatching occurred at 44.4--84.9 F and was optimum (38% hatched) at about 64 F. Incubation time varied from 15 days at 45 F to 3.7 days at 70 F and 2.1 days at 84 F. Time from start to finish of hatching ranged from 13 days at about 46 F to 2-3 days at 68-70 F and 1-2 days at 80-84 F. Survival of unfed larvae held at incubation temperatures increased from 3.8 days at 51 F to 7.6 days at 58-59 F and then decreased to 2.4 days at 80-82 F. (Sjolseth-Washington)
W70-08922

PESTICIDE MONITORING OF THE AQUATIC BIOTA AT THE TULE LAKE NATIONAL WILDLIFE REFUGE,
Federal Water Quality Administration, Klamath Falls, Oreg.
Patrick J. Godsil, and William C. Johnson.
Pesticides Monitoring Journal, Vol 1, No 4, p 21-26, 1968. 8 ref, 5 tab, 4 fig.

Descriptors: *Chlorinated hydrocarbon pesticides, DDT, Endrin, *Pesticide residues, Pesticide toxicity, Water pollution effects, *Monitoring, *Water quality, Aquatic environment, On-site data collections, On-site investigations, Clams, Water birds, Bass, Mortality, Bottom sediments, Aquatic plants, Oregon, California.
Identifiers: DDD, DDE, Chlordane, *Water quality monitoring, *Pesticide monitoring, Tule Lake (Calif), Lower Klamath Lake (Calif), Lost River (Oregon).

Over a 2-year period, samples of water, suspended material, submerged aquatic plants, clams, and fish were collected from the Tule Lake area and analyzed for chlorinated hydrocarbon pesticides. Compounds DDE, DDD, DDT, chlordane, and endrin were found regularly in samples of both water and biota. Water contained a maximum of 0.100 ppb of endrin in 1965, while tui chubs accumulated a maximum of 198 ppb during the same year. Concentrations of endrin in the other strata of the biota were distributed between these extremes of the food chain. The occurrence of endrin was directly associated with contaminated irrigation return water supplying the Refuge lakes. As the concentrations of studied pesticides increased in the drainage water, the biota also became contaminated. However, at the end of the season, as the concentrations decreased in the water, the biota was cleaned. Concentrations in both water and biota returned to or near analytical sensitivity (water--0.007 ppb; biota--4 ppb) between growing seasons. (Sjolseth-Washington)
W70-08923

OCCURRENCE OF PESTICIDES IN WHALES,
Bureau of Commercial Fisheries, Seattle, Wash.
Allen A. Wolman, and Alfred J. Wilson, Jr.
Pesticides Monitoring Journal, Vol 4, No 1, p 8-10, 1970. 2 tab, 16 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *DDT, *Dieldrin, Pesticide residues, Analytical techniques, Endrin, Aldrin, Gas chromatography.
Identifiers: *Gray whales, *Sperm whales, *Tissue samples, Brain tissues, Liver tissues, Blubber tissues, Tissue analysis, DDE, DDD, Toxaphene, Heptachlor epoxide, Polychlorinated Biphenyls, Methoxychlor.

Organochlorine pesticides were found in tissue samples of brain, blubber, and liver from 6 of 2 gray whales, Eschrichtius robustus, and in each of sperm whales, Physeter catodon, collected near San Francisco, Calif., in 1968 and 1969. Concentrations of DDT or its metabolities ranged up to 0.36 ppm in blubber tissue of gray whales, and 6. ppm in blubber tissue of sperm whales. The higher dieldrin concentrations were 0.075 ppm in gray and 0.019 ppm in sperm whales. (Sjolseth-Washington)
W70-08924

TEMPERATURE, REPRODUCTION AND BEHAVIOR,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
Charles C. Coutant.
Chesapeake Science Vol 10, No 3 and 4, p 261-274, 1969. 15 fig, 2 tab. AEC Contract AT (45-1)-1830.

Descriptors: Water pollution effects, Thermal powerplants, *Thermal stress, Thermal water, Water temperature, *Fish reproduction, *Fish behavior, *Fish populations, Fish physiology, Predation, Hatching, *Spawning, Fish management, Salmonids, Columbia River, Fish eggs, Viability, *Nuclear powerplants, Chinook salmon, On-site investigations, Mortality, Equilibrium, Washington.
Identifiers: Hanford (Washington), *Thermal effects.

Research being conducted on salmonid fishes at the Hanford nuclear complex on the Columbia River is discussed. Studies of thermal effects on reproduction and behavior include a 20-year, annual census of spawning chinook salmon near reactor discharges, laboratory experiments on incubation and rearing success at elevated temperatures, studies of equilibrium loss prior to thermal death and lethal temperatures, tests of relative predation rates upon thermally shocked and normal young salmonids, and tracking sonic tagged adults to determine migration behavior near thermal outfalls. (Sjolseth-Washington)
W70-08925

HISTOLOGICAL AND ELECTRON MICROSCOPICAL OBSERVATIONS ON COPPER POISONING IN THE WINTER FLOUNDER (Pseudopleuronectes americanus).
McGill Univ., Montreal (Quebec). Marine Sciences Centre.
Jeremy T. P. Baker.
J. Fish. Res. Board Canada 26: 2785-2793, 1969. 25 ref, 19 fig.

Descriptors: *Copper, Copper sulfate, Heavy metals, Water pollution effects, *Fish physiology, Fishkill, Mortality, *Toxicity, Electron microscopy, *Microscopy.
Identifiers: Winter flounder, *Pseudopleuronectes americanus, *Histology, Gill Lamellae.

Effects of high (3200 microgram/liter Cu (++)) medium, (560-1000) and low levels (180 microgram/liter Cu (++)) of copper on the morphology of winter flounder were investigated. High and medium levels resulted in fatty metamorphosis in the liver, necrosis in the kidney, destruction of the hemopoetic tissue, and gross changes in gill architecture. Light microscope studies showed that low levels of copper caused an extracted appearance in gill lamellae; the epithelial layer appeared vacuolated; the basi-lamellar region was reduced in thickness. Lamellar mucus cells were few compared with control specimens and chloride cells appeared in their stead. Electron microscope study of gill lamella from fish exposed to low levels of copper confirmed vacuolation in the epithelial layer. Also found were myelinlike figures, various membrane-bound vesicles, and apical homogene-

ous layers of reduced thickness. Increased amounts of particulate matter adhering to the external surface of the epithelial cells were apparent. Chloride cells were found instead of mucus cells. (Sjolseth-Washington)
W70-08926

SURVIVAL AND GROWTH OF LARVAE OF THE EUROPEAN OYSTER (OSTREA EDULIA L.) AT DIFFERENT TEMPERATURES,
Bureau of Commercial fisheries, Milford, Conn.
Harry c. Davis, and Anthony Calabrese.
The Biological Bulletin, Vol 136, No 2, p 193-199, April 1969. 2 tab, 1 fig, 9 ref.

Descriptors: Water temperature, Oysters, Growth rates, Larval growth stage, Mortality, Bioassay, Shellfish.
Identifiers: Ostrea edulis, Optimum growth temperature, Survival, Spat.

The temperature range for satisfactory growth of O. edulis larvae (70% or more of optimum) was from 17.5 deg. to 30C. The temperature range for satisfactory survival (70% or more of optimum) was from 12.5 deg. to 27.5C. Even at 10C survival was poor, perhaps, because the unfavorable temperatures weakened the larvae, making them more susceptible to bacterial toxins and diseases. In these experiments approximate setting times were as follows: 17.5C-26 days, 20C-14 days, and at 25 deg. 27.5 deg, and 30C beginning of setting varied from the 8th to the 12th days. More spat were obtained at 20 deg to 22.5C than at higher temperatures. It is suggested that larvae be reared to setting size at temperatures from 25 deg to 27.5C, then kept at 20 deg to 22.5C during setting to obtain fastest growth of larvae and highest percentage setting. Spat kept at 10C showed virtually no growth; at temperatures from 12.5C growth of spat increased with each increase in temperature. (Sjolseth-Washington)
W70-08927

THE pH TOLERANCE OF EMBRYOS AND LARVAE OF MERCENARIA MERCENARIA AND CRASSOSTREA VIRGINICA,
Bureau of Commercial Fisheries, Milford, Conn.
Anthony Calabrese, and Harry C. Davis.
Biological Bulletin, 1966. Vol 131, No 3, p 427-436. 6 tab, 10 ref.

Descriptors: *Hydrogen ion concentration, Clams, Oysters, *Larvae, Larval growth stage, *Embryonic growth stage, Resistance, Mortality, Bioassay, Growth rates.
Identifiers: *pH tolerance, Mercenaria mercenaria, Crassostrea virginica.

The pH range for normal embryonic development of oysters (Crassostrea virginica) was 6.75 to 8.75, and for clams, (Mercenaria mercenaria), 7.00 to 8.75. More than 68% of the larvae of both clams and oysters survived at pH 6.25 to 8.75. The lower pH limit for survival of oyster larvae was 6.00 and for clam larvae, 6.25. The pH range for normal growth was 6.75 to 8.50 for clam larvae and 6.75 to 8.75 for oyster larvae. The rate of growth of both species dropped rapidly at pH levels below 6.75. The optimum pH for growth was 7.50 to 8.00 for clam larvae and 8.25 to 8.50 for oyster larvae. At pH 9.00 to 9.50 the percentage of eggs that developed normally, the percentage of larvae that survived, and the percentage increase in mean length of both species decreased rapidly. (Sjolseth-Washington)
W70-08928

THE CHRONIC TOXICITY OF LINEAR ALKYLATE SULFONATE TO THE FATHEAD MINNOW (PIMEPHALES PROMELAS, RAF.),
Federal Water Pollution Control Administration, Cincinnati, Ohio. Newtown Fish Toxicology Lab.
Quentin H. Pickering, and Thomas O. Thatcher.
Journal of Water Pollution Control Federation, Vol 42, No 2, Part 1, Feb 1970, p 243-254. 8 tab, 28 ref.

Descriptors: Toxicity, Water quality, Detergents, Linear alkylate sulfonates, Effects.
Identifiers: Fish, Chronic toxicity.

A continuous flow bioassay was made for the appraisal of the chronic toxicity of linear alkylate sulfonate (LAS) to the fathead minnow (Pimephales promelas, Rafinesque). The toxicological effect investigated was fish production based on survival, growth, and reproduction. Statistical analysis of the data from newly hatched fry survival indicated a significantly greater mortality at the two high test concentrations. At a concentration of 0.63 mg LAS/1 fish production was similar to the control fish. An application factor obtained by dividing the maximum acceptable toxicant concentration by the 96-hour TLm value was found to be between .14 and .28.
W70-08930

BIOLOGICAL EFFECTS ON SEDIMENT-WATER NUTRIENT INTERCHANGE,
California Univ., Berkeley. Sanitary Engineering Research Lab; and Sunn, Low, Tom, and Hara, Inc., Honolulu, Hawaii.
Donald B. Porcella, James S. Kumagai, and E. Joe Middlebrooks.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA4, Paper 7460, p 911-926, August 1970. 5 fig, 8 tab, 10 ref. Contract AT (11-1)-34 - Project 100, AEC.

Descriptors: *Nutrients, *Bottom sediments, *Limnology, *Algae, *Eutrophication, Lakes, Water quality, Phosphorus, Phosphates, Productivity, Leaching.
Identifiers: Sediment-water nutrient-exchange.

Different types of sediments vary in their ability to support algal growth. This is related to the amount of available phosphorus measured in the sediments. Although the amount of phosphorus released from the sediments varied with the type of sediment, all of the available phosphorus eventually should be extracted in the 15-cm layer of sediment studied. The development of a thick mat of Oscillatoria caused an increase in productivity due to the increased transfer of phosphorus from the sediment; and, in general, the more productive systems had sediments containing greater amounts of phosphorus. Also, the equilibration of P-32 with stable phosphate occurred more rapidly in the more productive systems, and this rate of equilibration appeared to be associated with the sediments themselves. Hence P-32 exchange with stable P was related to the concentration of available phosphorus in the system. (Knapp-USGS)
W70-08944

5D. Waste Treatment Processes

ADVANCES IN WATER POLLUTION RESEARCH.
For primary bibliographic entry see Field 05G.
W70-08627

MODIFIED FILTER MEDIA FOR REMOVAL OF WATER POLLUTANTS,
Indian Inst. of Tech., Kanpur. Dept. of Civil Engineering.
G. D. Agrawal, and A. V. S. Prabhakara Rao.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 299-307, 1969. 9 p, 5 fig, 10 ref.

Descriptors: *Water pollution control, *Filtration, *Particle size, *Clays, *Silts, Sands, Algae, Plankton, Microorganisms, Turbidity, Analytical techniques, Laboratory tests, Foreign research.
Identifiers: *Filter media, Alumina-coated sand, Ferric oxide-coated sand, Crushed bauxite, Acid-washed bauxite, Kanpur (India).

Experiments were made to develop a simple filter, with modified media, for efficient removals of micro sized particles, whether used for disposal to exclude particulate pollutants from effluents or for water supply to remove particulate contaminants. Two pyrex glass tubes were used to contain the filter columns. The filter bed for all the runs was a 7.6 cm layer of shingle and coarse sand supporting an 18 cm layer of the media under study. Filter media consisted of untreated sand, sand coated with alumina, sand coated with ferric oxide, crushed low-grade bauxite and bauxite washed with acid. Water with less than 10 mg/l. turbidity could be produced by filtration of raw stream water (influent turbidity 46 mg/l.) or raw pond water (influent turbidity 32 mg/l.) and reduced the total bacterial numbers by about 50%. (Woodward-USGS)
W70-08628

STREAM REAERATION USING MOLECULAR OXYGEN,
Crown Zellerbach Corp., Camas, Wash. Dept. of Manufacturing Services.
For primary bibliographic entry see Field 05G.
W70-08644

VISCOSE RAYON FACTORY WASTES AND THEIR TREATMENT,
C. P. Sharda, and K. Manivannan.
Technology (Sindri, India) Spec. Issue, Vol 3, No 4, p 58-60, 1966.

Descriptors: *Sulfides, Neutralization, Alkalinity, Acidity, Trickling filters.
Identifiers: *Viscose rayon, Zinc compounds, Tire cord.

The process of viscose rayon manufacturing is briefly described. The effluents from the factory are classified as alkaline viscose residues, acid sulfide, and sanitary. The combined waste treatment may be difficult and sep. treatment is recommended. The process adopted includes neutralization and settlement, incineration, neutralization with lime or limestone and trickling filter. The addnl. problem of removal of zinc compounds from viscose tire cord plant residues is mentioned. (Livengood-North Carolina State)
W70-08655

FLOCCULATION AND DEFLOCCULATION OF AN AQUEOUS SUSPENSION OF CHLORELLA,
Tokyo Univ. (Japan). Inst. of Applied Microbiology.
Shuichi Aiba, Takeshi Watanabe, and Makoto Hirata.
Journal of Fermentation Technology, Vol 48, No 3, p 125-136, 1970. 10 fig, 1 tab, 16 ref.

Descriptors: *Flocculation, *Chlorella, Suspension, Turbidity, Size, Surface tension, Shear stress, Viscosity, Sewage, Industrial wastes, Activated sludge, Cultures, Mathematical studies, Light intensity, Temperature, Sludge.
Identifiers: *Deflocculation, *Aqueous suspensions, Sensor, Cadmium sulfide, Chlorella vulgaris.

Many questions on flocculation and deflocculation of sludge remain to be resolved. The primary purpose of this study was the establishment of a method for assessing the process of microbial flocculation and deflocculation in a generalized fashion, Chlorella being a favorable test organism. A specific sensor of cadmium sulfide was constructed for a continuous assessment of flocculation and/or deflocculation of a dilute and well-dispersed aqueous suspension of Chlorella cells in an agitated vessel. Reading of a millivolt recorder in a circuit of the sensor could readily be converted to the turbidity value; this was correlated fairly well with the mean surface diameter of the floc. The decrease/increase of turbidity of the cell suspension reflected progress of flocculation or deflocculation. Good reversibility, depending on agitation intensity, was confirmed between flocculation and

deflocculation of the cell suspension. Water content of floc in the vessel was also correlated favorably with the ratio of the mean floc size to the cell diameter. The deflocculation was analyzed from a force balance between the pseudosurface tension of the floc and the shear stress due to the liquid viscosity. (Jones-Wisconsin)
W70-08656

MINE WATER TREATMENT--FRICK DISTRICT,
United States Steel Corp., Pittsburgh, Pa.
R. R. Godard.
Mining Congress Journal, Vol 56, No 3, p 36-40, 1970. 4 fig, 6 photos.

Descriptors: *Mine wastes, *Acid mine water, *Coal mine wastes, *Mining, *Mine drainage, Settling basins, Lime, Iron, Alkalinity, Water pollution sources, Water treatment, Waste water treatment, Industrial wastes, Pennsylvania, Sludge disposal, Fertilizers, Productivity.
Identifiers: US Steel Corporation, Frick District (Pa), Mine water treatment.

A short history of US Steel's attempts at pollution abatement since early 1900's is presented. Neutralization of acid mine water with lime was practiced in 1915 and potable water used to quench coke. Treatment problems were similar to those today. Expense of neutralizing treatment was compensated by selling the precipitate as fertilizer and for removing hydrogen sulfide from natural gas. In 1957 settling ponds were built in Frick District to settle ferric iron from alkaline mine water; discharge from the current pond contains less than 7 milligram/liter iron. Maple Creek mine reduced alkalinity of 350-610 milligram/liter to 330-420 milligram/liter by aeration and holding pond system. Treatment of mine waters with pH of 2.9-33, acidity of 500-1600 milligram/liter and iron content of 300-800 milligram/liter from Robena mine resulted in water with pH 7.3-8.5 and total iron content of 2 to 4 milligram/liter, and no acidity. Treatment facility includes 8 million-gallon raw water storage pond, variable speed lime feeder, slurry mixing chambers, aerating basin, and 140 million-gallon settling pond. (Bannerman-Wisconsin)
W70-08668

APPLICATION OF THE DISSOLVED OXYGEN ELECTRODE TO TREATABILITY STUDIES OF INDUSTRIAL WASTES,
Department of Water Resources, Durham, N.C.
Leslie A. Matthews.
Southern Water Resources and Pollution Control Conference, Vol. 13, p 89-96, April 1964. 9 fig, 6 ref.

Descriptors: *Biological treatment, Respiration, Oxygen, Electrodes, Waste waters, North Carolina, Biochemical oxygen demand, Dissolved oxygen.
Identifiers: *Textile mill wastes, *Metal plating wastes, pH.

Industrial wastes can be treated biologically when the wastes are not toxic to the organisms, and proper environmental and nutritional requirements are met. A respiration technique using an oxygen electrode to evaluate the biological treatability of the waste waters does not require pilot plants or extensive time and equipment. This technique is especially useful in determining the effects of unknown wastes on a biological system. Results of studies on metal plating and textile wastes made at Durham, North Carolina, are given. BOD, pH, dissolved oxygen content, and oxygen uptake are emphasized. (Lonon-North Carolina State)
W70-08729

ANAEROBIC DIGESTION OF INDUSTRIAL WASTES,
C. A. Sastry, and G. J. Mohanrao.
Environmental Health (India), No 5, p 279-288, 1963. 5 tab, 57 ref

Descriptors: Biochemical oxygen demand, Soaps, Chemical analysis, Anaerobic digestion.
Identifiers: *Wool scouring wastes, Wool grease.

In a section, pages 285-286, the problem of wool scouring wastes is discussed very briefly with a table giving the composition of a typical sample. The entire article covers the anaerobic digestion of industrial wastes with special references to waste waters from slaughterhouses, distilleries, yeast culture, paper mills, dairies, and pea processing. (Livengood-North Carolina State)
W70-08730

FINDING THE BEST WAY TO TREAT WASTES FROM A BLANKET MILL,
Chatham Mfg. Co., Elkin, N.C.
Arthur L. Smith.
Waste Engineering, Vol. 32, No. 5, p 230-233 and 257, 1961. 9 fig, 1 tab.

Descriptors: *Aeration, Wastes water, Copper compounds, Fibers, Screens, Suspended load, Biochemical oxygen demand, Sludge, Cotton, Sludge digestor, Dissolved oxygen, Order.
Identifiers: *Textile mill wastes, Pilot study, Dyehouse wastes, Blanket mill wastes, Wool grease, Mordant dyes, Antibacterial finishes, Wool, Rayon (Regenerated cellulose fibers), Acrylic fibers, Polyamides, Yadkin River, North Carolina Stream Sanitation Committee, pH.

A four-year pilot study was made dealing solely with development and design of modified aeration techniques. The wastes to be treated included dyehouse wastes, wool grease, chrome dyestuffs, copper fixing agents a bacteriostactic agent, and wool, rayon, cotton, acrylic, and polyamide fibers. The Yadkin River into which these wastes were discharged was classified as a Class C stream by the North Carolina Stream Sanitation Committee. A 60-mesh vibrating screen was used to take out large suspended solids. The wastes were aerated most satisfactorily at a pH of 7.0 to obtain a high removal of BOD. Sludge was picked up by air lifts and taken back to the aeration tank or to the sludge diester. A 3:1 air-to-wastes ratio was found to be the minimum at which the dissolved oxygen content could be maintained at required levels. If needed, the sludge was aerated while in the digestor. Nuisance from odors was created in either the wastes or in the sludge using this method. (Lonon-North Carolina State)
W70-08731

WATER CONSERVATION AND POLLUTION ABATEMENT,
R. Hobart Souther.
American Dyestuff Reporter, Vol. 51, No. 9, p 41-44, April 30, 1962. 2 tab.

Descriptors: *Aeration, Water conservation, Water pollution, Waste treatment, Trickling filters, Activated sludge.
Identifiers: *Textile mill wastes, Biosorption.

The great increase in water usage has brought about an urgent need for more research and trained personnel in water conservation. Research funds for water pollution studies need to be spent on applied research rather than basic research. With todays new methods and equipment, proper waste treatment is not as costly as it once was. Particularly successful in textile waste treatment is the aeration lagoon process. Highly alkaline mill waste waters combined with sewage can be treated in trickling filters combined with activated sludge processes without chemical adjustments. The biosorption process can also be used to increase the capacity of conventional sludge plants. Results and costs of aeration techniques are given. (Lonon-North Carolina State)
W70-08733

BIOLOGICAL TREATMENT OF TEXTILE WASTES,
Weston (Roy F.), Inc., Newton Square, Pa.
Vernon T. Stack, Jr., E. L. Jones, T. A. Alspaugh, and H. B. Stokes.
Purdue University Engineering Extension Series Series No. 109, Vol. 46, No. 2, p 387-422, March 1962. 29 fig, 5 tab, 2 ref.

Descriptors: *Biological Treatment, Waste water North Carolina, Streams, Biochemical oxygen demand, Color, Activated sludge, Aeration, Cotton.
Identifiers: *Textile mill wastes, pH.

Laboratory and pilot studies were made to design biological treatment facilities for the waste water from four textile plants in Greensboro, North Carolina. Three million gallons per day of waste from cotton goods processing are discharged into North Buffalo Creek. This stream is classified a class D stream by the North Carolina stream Sanitation Committee. The wastes are high in BOD, color content, and pH. Satisfactory treatment is accomplished by activated sludge in complete-mixed process. A 98 percent removal of BOD is obtained in warm weather. Wastes are aerated at pH 11.5 without neutralization. This aeration gives an effluent pH of 8.5. Color removal is 80 percent. (Lonon-North Carolina State)
W70-08734

CAUSTIC RECOVERY HELD TO PAY HALF ITS COST IN YEARS,
Allied Chemical Corp., Syracuse, N.Y. Solvay Process Div.
W. R. Steele.
Daily News Record, No. 190, No. 21182, p 41 September 29, 1961.

Descriptors: Water pollution, Surveys.
Identifiers: *Textile mill wastes, *Sodium hydroxide, Recovery (Chemical), Cotton system processing, Dyehouse wastes.

Caustic soda recovery and reutilization procedures in cotton finishing plants result in annual savings exceeding 50 percent of the initial investment. These savings result even though it might be necessary to collect, evaporate, filter, dialyze, re-evaporate, and treat the final wastes. Other beneficial side effects are increased yardage return and alleviation of water and air pollution. All plant officials are urged to have a caustic utilization survey made if considering such a system. (Lonon-North Carolina State)
W70-08736

HOLDING AND AERATION OF COTTON MILL FINISHING WASTE,
North Carolina State Univ., Raleigh.
Nelson L. Nemerow.
Proceedings, 5th Southern Municipal Industrial Waste Conference, Chapel Hill, North Carolina, 1956, p 149-156. 3 tab, 7 ref.

Descriptors: *Cotton, Waste waters, Pilot plant, Model studies, Biochemical oxygen demand, Aeration, Lagoons.
Identifiers: *Textile mill wastes, *Dyehouse wastes, Desizing wastes, Starch, Bleaching, Dyeing, pH, Kiering.

A pilot plant study was made of methods of treating waste water from a textile mill engaged in the processing of cotton fabrics. The wastes intering the effluent were from desizing, kiering, bleaching, and dyeing. The starch from the desizing step is the main source of BOD. (1) Ten hours of holding and 12 hours of aeration with pH control reduced BOD by 71-79 percent. (2) Twenty seven of holding alone reduced BOD by 56 percent and an additional 12 hours of aeration brought this to 75 percent. (3) Three hours of holding and 7 hours of aeration produced a reduction of 49 percent. (4) As holding time was reduced, more CO2 for neutralization was required. (5) With no neutralization and a pH of 11.3 only 39 percent reduction was secured in 10 hours holding and 12 hours of aeration. (6) The pH dropped from 11.3 to 9.9 during aeration. (7) A bacterial count of 5

million was found even in highly alkaline waste water. (WorkeNorth Carolina State)
W70-08739

EFFLUENT PURIFICATION OF A BLEACHING AND DYEING PLANT,
Josef Wittman.
Melliand Textilberichte, Vol. 38, No. 6, p 679-680, June 1957. 3 fig.

Descriptors: *Chemical precipitation, Iron, *Aeration, Industrial wastes.
Identifiers: *Textile mill wastes, Bleaching, Dyeing, Dyestuffs.

The problems of treatment of industrial waste waters is discussed and a process is described for the treatment of waste waters from bleaching and dyeing. The process is based on the use of chemical precipitation by metallic iron in the form of waste filings which are stirred, with aeration, with the waste waters in a concrete-covered tank. (Livengood-North Carolina State)
W70-08741

FOR HOSIERY FINISHERS: WHY BIODEGRADABLE DETERGENTS HELP SOLVE SEWAGE DISPOSAL PROBLEMS,
Harry White.
Hosiery and Underwear, Vol. 49, No. 8, p 56-58 and 64, August, 1966. 2 fig.

Descriptors: *Biodegradation, Biochemical oxygen demand, Waste waters, *Detergents, Biological treatment, Sewage treatment.
Identifiers: *Textile mill wastes, *Hosiery dyeing, Dyehouse wastes.

The BOD, pH, volume, odor, and color determine treatment for the waste waters from hosiery dyehouses. Usually, if the effluents are discharged into a large municipal sewage-disposal system, no problems arise. But, smaller systems may not be able to handle the wastes. A case history in a small southern town is given. Nonionic detergents resist biodegradation . The river die-away test, the shake flask method, and the laboratory schal sewage plant system are three biological test useful in determining biodegradability. Although biodegradable detergents enhance sewage disposal, they do not eliminate all disposal problems. (Lonon-North Carolina State)
W70-08742

WASTE PROBLEMS ASSOCIATED WITH DYEING AND FINISHING OF SYNTHETIC FIBERS,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
S. G. Turnbull, Jr.
Southern Water Resources and Pollution Control Conference, Vol. 5, p 170-178, April 1956. 4 tab, 10 ref.

Descriptors: *Biochemical oxygen demand, Waste waters, Adhesives, Fibers, Phenols, Carriers, Biological treatment, Cotton.
Identifiers: *Textile mill wastes, Starch, Gums, Sizes (Slashing), Dyeing, Warp sizes, Man made fibers, Carrier dyeing, Desizing wastes, Dyehouse wastes.

Starches and gums applied during the yarn slashing stage account for 50 percent of the BOD in waste waters from a conventional cotton finishing plant. The BOD can be significantly reduced by substituting synthetic sizes for natural gums and starches. Waste waters from the dyeing of hydrophilic fibers have BOD values similar to those from wool and cotton dyeing. Phenols must be removed or destroyed to avoid ruining the taste when the water is reused. Carriers used in dyeing hydrophobic fibers present special problems. Bacterial decomposition is recommended to eliminate these phenolic types. The trend in fabric finishing is away from the natural compounds which give high BOD. (Lonon-North Carolina State)
W70-08743

WASTE DISPOSAL: A GROWING HEADACHE,
Irving Teplitz.
Textile Bulletin, Vol. 90, No. 6, p 70-74, June, 1964. 2 fig, 24 ref.

Descriptors: *Waste water disposal, Biological treatment, Waste treatment, Iron compounds, Lime, Trickling filters, Chemical precipitation.
Identifiers: *Textile mill wastes, Chemical treatment, Alum, Ferrous compounds.

The legal aspects of industrial wastes disposal can no longer be ignored. Textile wastes, e.g., floating matter, settleable suspended matter, colloidal impurities, acids and bases, and dyes, must be removed from plant effluents. Biological waste treatment is usually preferred because of cheaper operating costs. Often prevention eliminates the need for waste treatment facilities. Chemical treatment may involve the use of alum, iron or lime, ferrous sulfate and lime, ferric sulfate and lime, chlorinated ferrous sulfate, ferric chloride, ferrous chloride, lime alone, or sulfuric acid and sulfur dioxide. Biological treatment may include lagoons, activated sludge, trickling filters, hi-lo activated sludge, or the Zimmerman Process. Alkyl arylsulfonates, wool grease, and other special wastes present unique problems. (Lonon-North Carolina State)
W70-08744

BIOLOGICAL TREATMENT OF WOOL SPINNERY WASTE,
Fermentation Research Inst.
Masao Tanaka, Michio Dazai, Yorikazu Sonoda, Michiaki Sato, and Itideo Ono.
Kogyo Kagaku Zasshi (Journal of the Chemical Society of Japan, Industrial Chemistry Section) Vol. 67, No. 5, May 1964, p770-776.

Descriptors: *Biological treatment, Methane bacteria, Waste storage, Activated sludge, Waste water, Biochemical oxygen demand, Suspended load.
Identifiers: *Textile mill wastes, *Wool wastes, Dyeing, Wool, Wool grease.

Laboratory and pilot plant tests of wool spinning waste treatment were conducted. The wastes are treated by thermophilic methane fermentation. The digestive fluid from the fermentation step and other wastes are mixed in a lagoon. Then, the effluents are treated by the activated sludge process. BOD, grease content and suspended solid levels are satisfactory after this treatment. (Lonon-North Carolina State)
W70-08745

TEXTILE WASTE TREATMENT: WHAT TO DO ABOUT IT,
Cannon Mills Co., Kannapolis, N.C.
J. L. Brown.
Mechanical Engineering, Vol. 82, No. 6, p100, June 1960.

Descriptors: *Treatment facilities, Domestic wastes.
Identifiers: *Textile mill wastes, Sodium hydroxide, Starch, *Slashing wastes, *Bleaching wastes.

The equipment and techniques used at the Kannapolis, North Carolina mills of Cannon Mills are described. Wastes being treated consist of domestic sewage from the mills and mill village and certain wastes from the bleachery and slasher rooms (chiefly starch) and a 3 percent caustic solution used as a cleaning agents. A two-year study showed that treatment could best be effected if the wastes were segregrated at the bleachery and piped separately to the treatment plant. The starch was treated immediately, while the caustic was treated on a seven-day basis. The following units are used in treatment: a caustic storage lagoon, primary clarifiers, trickling filters, secondary clarifiers, a chlorine contact tank, sludge digesters, and vacuum filtration of sludge. Modifications in the system since its inception to improve efficiency are described. (Dandridge-North Carolina State)
W70-08746

PHYSICOCHEMICAL CHARACTERISTICS OF RESIDUAL WATERS AND TREATMENT EXPERIMENTS AT A COMPLEX TEXTILE MANUFACTURER,
Ministry of Light Industry, Bucharest (Rumania). Central Lab.
Maria Rusanovschi, Elena Iliescu, and Bathia Zilberstein.
Industria Textila (Bucharest, 17, (3), p160-165, 1966.

Descriptors: Biochemical oxygen demand, Hydrogen sulfide, Coagulation, Absorption, Chemical precipitation.
Identifiers: *Felt manufacturing plant, *Felt, Wool, Dyestuffs, Dyehouse wastes, Chromium compounds.

Studies were made on residual waters coming from a felt manufacturing plant. The total volume of residual waters in 5,000-6,000 m. 3/24 hrs. and contains large amounts of vegetal, animal, and synthetic materials. The water from the preliminary treatments of the wool are dark colored, contain suspended matter and fats, and have an alkaline reaction. They represent 1.3 percent of the total residual waters, but being the dirtiest they influence the total effluent. They analyze: pH 8.5-10, H2S 42.5-56.1 mg./l., KMn04 index 3700-4100, and B.O.D. (5-day) 1200-1500 mg./l., total fats 1.9-2.8g./l. The finishing waters contain dye residues, inorg. salts, detergents, H2S, and chromium compounds. The waters from the dyeing operation represent 57.6 percent of the total residual water; their characteristics are: pH 7.5, dark in color, H2S 23.4 mg./l., suspended matter (cellulose, short wool fibers) 354 mg./l., and pocess a low KMn04 index and low B.O.D. (5-day). The chemical methods for the treatment of the total residual water are coagulation and absorption. For coagulation, the following were used: (a) FeS04, (b) Al2 (S04)3 (c) FeCl3, (d) CaO, and (e) H2So4. For good results, the optimum amount of (a) = 1000-15000 and for (d) = 700-1000 mg./l. The sludge resulting from the treatment contains 58 percent inorg. matter: N 1.4-2.0, K as K20 3.5-6.3, and P as P205 0.1-0.25 percent. For adsorption, the following were used: activated charcoal, lignite slag, and residues of ion exchangers. The best results were obtained with activated charcoal. In general, absorption is too expensive to be used. (Livengood-North Carolina State)
W70-08747

COOLING TOWERS GET BIGGER AND BETTER AS WATER DEMANDS GROW.

Power Engineering, Vol 69, No 12, p 38-41, December 1965. 5 fig, 4 ref.

Descriptors: *Cooling towers, *Cooling water, *Thermal pollution, *Construction materials, Iron, Steel, Aluminum, Plastics.
Identifiers: *Redwood, *Service life, Natural draft, Mechanical draft.

The most important item in choosing a powerplant site is a source of cooling water. The problem of thermal pollution arises if a river cannot support the cooling load. Cooling towers, therefore, are needed to correct this problem. The two major types of cooling towers are the natural-draft and the mechanical draft. These towers are built of standard materials and coatings which are designed to provide satisfactory service life under normal conditions. Normal conditions include circulating water pH of between 6 and 8, chlorine content below 750 ppm, sodium bicarbonate content below 200 ppm, maximum temperature of 140F, and many other set standards. The standard materials include grey cast iron, nodular iron, steel, stainless steel, cast aluminum, wrought aluminum, copper alloys, redwood, Douglas fir plywood, asbestos cement, glass fiber reinforced polyester, resins, polypropylene, high density polyethylene, and many miscellaneous materials. If the standard materials are placed under abnormal conditions, special fasteners or heavy duty coatings may be required. (Osborne-Vanderbilt)
W70-08830

WORLD'S LARGEST HYPERBOLIC TOWER COOLS A POWER PLANT.

Engineering News-Record, Vol. 178, No. 5, p 58-59, May 4, 1967. 2 fig.

Descriptors: *Cooling towers, *Powerplants, Cooling water, Turbines, Condenser, Cast-in-place structures, Humidity, Water temperature, Thermal pollution, Thermal powerplants.
Identifiers: *Monongahela River, Cross-flow, Natural draft.

The world's largest cooling tower - a 370-ft-high, 378-ft-diameter, hyperbolic concrete shell - cools 360 million gallons of water per day for the new 130 million dollar, Fort Martin, W. Va., power plant. The two natural draft cooling towers, combining a cross-flow cooling system with a hyperbolic natural draft air flow system, is the most suitable and economic type for the large quantities of cooling water required. Each tower will be capable of cooling 250,000 gallons per minute from 114F down to 90F. The towers, according to Marley, are built to withstand a 30 psf surface load or a 100 mile per hour wind. To achieve this, each shell is supported on 70-ft-long precast concrete X-frame columns. In building the towers, Marley used specially designed steel form panels and platforms, which hange from previously placed concrete lifts, eliminating the need for conventional scaffolding. The reasons for the giant dimensions were to prevent fogging along the Monongahela River and to guard against a discharge of 720 million gallons of heated water a day. (Osborne-Vanderbilt)
W70-08837

WASTE WATER DISPOSAL ENHANCES AN AREA ECOLOGY,
Campbell Soup Co., Napoleon, Ohio.
G. Marvin Shutt.
Industrial Water Engineering, Vol 7, No 3, p 18-22, March 1970.

Descriptors: *Waste water treatment, Biochemical oxygen demand, Design, Economic efficiency, Microorganisms, Hydraulics, Slopes, Texas, Paris (Texas).

The development of the overland-flow technique of waste water treatment and disposal which won for Campbell Soup Co. the Sports Foundation's in 1969 Gold Medal Award for Best Single Plant Program in industrial water pollution abatement was presented. Plant waste water originated from two main sources: the cooling area and the vegetable washing area. The plant's waste water containing suspended and dissolved organic impurities - 550-900 ppm of BOD - was sprayed along the top of the watershed by conventional irrigation sprinklers. As it percolated through dense vegetative sod to the soil's surface the waste water left behind most of the suspended solids and it trickled downhill the dissolved impurities were subjected by soil microorganisms to biological degradation. Purified water collects at the terrace and flows to the receiving stream via prepared waterways. A study of underlying reasons for performance was prompted in 1968 and design parameters for increased capacity or efficiency of the existing system were developed. Four test sites comprising ten acres of the Paris, Texas cannery field were subjected to intensive scrutiny. Microorganisms activity, hydraulic loading, degree of slope and length of slope were the desired design parameters developed. A list of landmarks in the development of the program was given. The results of the two-year research effort was significant in that it assures success with overland-flow waste treatment for other processors in other locations (Kriss-Cornell)
W70-08850

WASTE WATER CHARGES IN GREAT BRITAIN,
West Hertfordshire Main Drainage Authority, Rickmansworth (England).
R. Wood
Industrial Water Engineering, Vol 7, No 1, January 1970, p 27-29. 2 fig

Descriptors: *Industrial wastes, *Waste treatment, *Optimum development plans, *Costs.
Identifiers: McGowan strength, *Process oxygen demand (POD).

A description of charges for industrial waste treatment in Great Britain which serve as a means of controlling the quality of the wastes discharged to the sewer, thereby controlling in turn the influent quality at the municipal treatment plant was given. The authorization of a charge for the service of sewerage and treatment at the minicipal treatment plant was initiated in 1937 and in 1961 the powers of the local authorities were extended. The policy described is that of the Institute of Water Pollution Control. An example given was that of the Mogden works of the Middlesex County Council where they first devised a volume/strength/solids formula which proved workable over a wide range of industrial wastes. To be effective the formula given stemed from an accurate calculation of the net costs of treatment at the municipal treatment plant. Rates themselves were included andadministrative overheads divided between capital and revenue expenditure. The WHMDA had operated a charging scheme based on this formula for a number of years. For non-inhibiting wastes, the use of the McGowan strength in volume/strength/solids formula assessed treatability to some extent. This was a calculation of the oxygen requirement for complete oxidation. Examples of the use of this method were given. 'Process oxygen demand' (POD) was suggested by Simpson as charges for industrial waste treatment based on requirements of the process to effect treatment. He indicated the possible breakdown of unit processes and his formula was shown. Control of industrial wastes could achieve optimum operating condition at the treatment plant and a minimum charge to both the general ratepayers and the industrial waste discharge achieved. (Kriss-Cornell)
W70-08853

WATER QUALITY IMPROVEMENT BY PHYSICAL AND CHEMICAL PROCESSES.
Texas Univ., Austin. Center for Research in Water Resources.

Water Resources Symposium No. 3, Center for Research in Water Resources, Austin, University of Texas Press, 1970. 448 p.

Descriptors: *Waste water treatment, *Water reuse, *Water quality, Standards, Tertiary, Wildlife, Estuaries, Agriculture, Design, Liquid wastes, Phosphorus, Ion exchange, Membrane processes, Sludge, Sludge disposal.
Identifiers: *Criteria, Sludge handling.

The most recent developments in the physical and chemical treatment of waste waters and handling and disposal of sludges were the subject of a special lecture series held in April 1969, at The University of Texas at Austin. The papers prepared for this third Water Resources Symposium sponsored by The University's Center for Research in Water Resources are presented. The content is particularly significant in the advanced treatment and technology now being considered for our expanding urban areas. The publication is divided into four sections. The first concerns itself with water quality requirements for reuse emphasizing criteria, objectives, and general water requirements, reuse of water by fisheries and wildlife facilities using both fresh water and estuarian systems. Problems of municipal reuse are described depicting actual plant operations. The second deals with functional designs related to the removal of settleable and suspended solids both in America and Europe. The third presents functional designs related to chemical treatment of liquid wastes. Implications are evaluated. Both theoritical discussions and practical applications are provided. And the forth treats of functional designs related to sludge separation and analysis of general sludge characteristics, thickining, sludge filtration and sludge conditioning, centrifugation, and disposal of sludge on land. (For individual papers see W70-08865 thru W70-08895). (Hancuff-Texas)
W70-08864

NATIONAL WATER QUALITY CRITERIA AN OBJECTIVES,
Federal Water Pollution Control Administratio
Washington, D.C.
Joe G. Moore, Jr.
In: Water Quality Improvement by Physical an Chemical Processes, University of Texas Pres Austin, 1970, p 3-9.

Descriptors: *Water quality, *Standards, Wate Quality Act, Legislation, Federal governmen State governments.
Identifiers: *Criteria, Objectives, Responsibility Agencies, Inforcement.

The federal program setting water quality sta dards, some of the assumptions which have bee made and experience which has been gained, th impact of this program on State Water Pollutio Control programs, and general ideas on the subje of water quality standards are discussed. The Wate Quality Act stipulated that the states at their optio had the first opportunity to establish standards an gave them until June 30, 1967, to do so. Thes standards then became subject to review and ap proval as federal standards by the Secretary of th Interior. After that date the Act permitted th Secretary of the Interior to establish standard directly. The Act does prescribe the mode of sta dard setting that emphasized federal-state coopera tion, and this provision had important con sequences. An unprecidented amount of state ac tivity in water pollution control was caused by th inclusion of a financial bonus tagged to waste wate treatment works construction grants for state which had established standards. Two basic con cerns of FWPCA are (1) the standards be practica and forceful and (2) they reflect natural condition when possible. The standards as of March 1969 have been approved by 49 out of the 50 states Only in the state of Iowa does disagreement as t the degree of treatment persist. Several kinds o criteria are found in the standards. Key numerica parameters are dissolved oxygen which range fro 3.5 to 7 mg/l for protection of various aquatic life pH with a general range of 6.5 to 8.5 determined b natural conditions, temperature where maximu limits are based on natural temperatures with per missible change from natural of not more than deg F and coliform organisms for which the tradi tional public health limits have been applied. (Se also W70-08864). (Hancuff-Texas)
W70-08865

GENERAL WATER QUALITY REQUIRE MENTS,
Wisconsin Univ., Madison.
James E. Kerrigan, and Gerald A. Rohlich.
In: Water Quality Improvement by Physical an Chemical Processes, University of Texas Press Austin, 1970, p 10-15. 6 ref.

Descriptors: *Water quality, *Standards, Wate Quality Act, Controls, Monitoring, Variability.
Identifiers: *Criteria, Requirements, FWPCA Water uses.

Quality identifies the degree of excellence which thing possesses. The fundamental point is that th assignment of a level of quality to water is relativ depending upon the use for which the water is as signed. To evaluate the characteristics of water it i essential to know whether these characteristic have any detrimental effect on the assigned use Thus pollution has come to mean the introductio or persistence of any material in the resource whic interferes with alters, or destroys some beneficia use. In our society it is recommended that w develop criteria for domestic water supplies recreation, agriculture, irrigation, fish and wildlife industrial water and aesthetic uses. Each of these use areas is influenced individually by the presence and concentration of key water characteristics. Fo a parameter to be useful in the development, i must meet the following demands: (1) It should in dicate whether the water has been adversely af fected for some use. (2) Its measurement should be practical, reproducible and relatively accurate. (3 Its measurements taken at sufficient interval

hould identify the variability and give the statistical relevance of the parameter. (4) Its data should eflect the nature of its long-term variability. It is mphasized that the level of treatment required for he quantities of waste discharged allowable be dicated by the characteristics of the receiving waters nd the effects imposed on these waters by the ischarged rather than the use of a uniform effluent tandard. (See also W70-08864). (Hancuff-Texas)
V70-08866

VATER QUALITY REQUIREMENTS FOR REUSE BY FISHERIES AND WILDLIFE,
Bureau of Sport Fisheries and Wildlife, Fort Collins, Colo.
Croswell Henderson.
n: Water Quality Improvement by Physical and Chemical Processes, Univ of Texas Press, Austin, 970, p 16-23. 23 ref.

Descriptors: *Water reuse, *Standards, *Fisheries, Wildlife, Water quality, Water resources, Sewage reatment, Waste water treatment, Recreation, Research and development, Toxicity.
Identifiers: *Criteria, Organisms.

The pollution situation today with respect to fish nd wildlife is not particularly bright. The FWPCA ublished an annual report since 1960 entitled Pollution Caused Fish Kills.' The 1967 report ublished in 1968 shows over 11 million fish killed y pollution caused incidents reported from 40 tates. Of the total number of fish, 71% reported illed by industrial wastes, 16% by agricultural vastes and 8% by municipal wastes, and the emainder by other causes. Of the 375 separate incidents reported 139 were caused by industrial vastes, 91 by municipal wastes, 90 by agricultural vastes. The major requisite to maintaining a fishery s to have an adequate quantity of water as well as a vater of satisfactory quality at all times during the ear. From the standpoint of fisheries, the primary bjective by establishing water quality standards is o observe the survival, reproduction and well-eing of aquatic organisms. Standards must be ased on a thorough knowledge of the environmental requirements of those organisms that must be rotected. A summary is presented of the key riteria and recommendations considered to be atisfactory for aquatic life and wildlife. These contain such variables as dissolved materials which include toxic materials, pH, alkalinity, acidity, temperature, dissolved oxygen, carbon dioxide, oil, turbidity, settleable material, color, floating material, tanking substances, radionuclides, plant nutrients and toxic substances. These variables are evaluated for aquatic organisms as well as water fowl and other wildlife. (See also W70-08864). (Hancuff-Texas)
W70-08867

FISHERIES AND WILDLIFE IN THE MARINE HABITAT AND SOME RELATED WATER QUALITY REQUIREMENTS,
Texas Parks and Wildlife Dept., Rockport.
Earnest G. Simmons.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 24-30. 39 ref.

Descriptors: *Water quality, *Fisheries, *Wildlife, *Estuaries, Salinity, Temperature, Dissolved oxygen, Pollutants, Physical properties.
Identifiers: *Marine environment.

A variety of definitions is given for the word 'estuary,' with the final most generally accepted definition as: an estuary is a semi-enclosed coastal body of water having a free connection with the open sea and within which the sea water is measurably diluted with fresh water deriving from land drainage. The importance of estuaries are emphasized from a standpoint of being indispensable to water fowl, pelicans, quail, cranes, eagles, osprey, and shore wading birds. In addition they are important as nursery grounds for such fish as spotted sea trout, channel bass, and red fish. Estuaries are very important from the standpoint of spawning grounds. Destruction of the estuaries would eliminate or adversely affect commercial shrimp, oysters, blue crabs, menhaden, red fish, and many other forms of marine life vital to the food chain. The factors discussed effecting wildlife in estuaries are salinity, temperature, dissolved oxygen, pesticides, and other pollutants, the latter being mostly industrial. The first three of the aforementioned has a wide range of acceptability; however, the last two categories present problems in determining the exact defects of such complex problems. (See also W70-08864). (Hancuff-Texas)
W70-08868

MUNICIPAL REUSE OF WATER,
National Inst. for Water Research, Pretoria (South Africa).
G. J. Stander, and L. R. J. van Vuuren.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 31-48. 19 fig, 3 tab, 7 ref.

Descriptors: *Water reuse, *Tertiary treatment, *Domestic water, Sewage treatment, Waste water treatment, Water supply, Reclamation, Activated carbon, Filtration, Chlorination.
Identifiers: *Pretoria (South Africa), *Criteria, Fractionation, Flotation, Ammonia stripping.

The return flows which are available at sewage purification plants serving metropolitan areas in South Africa constitute a major proportion of the fresh water intake. The optimization of municipal reuse requires a critical appraisal of a number of important factors. For example, whereas the quality of secondary purified sewage effluents in South Africa is generally suitable for cooling water and limited industrial use, advanced purification is required for domestic quality water for general distribution. A comparison of the quality of reclaimed water with the national standards for drinking water is tabulated. The criteria is broken into four main parts; (1) potability, dealing mostly with metallic ions, (2) health hazards dealing with potentially dangerous ions, (3) toxicity covering most of the heavy metals, and (4) chemical indicators of pollution as COD, BOD total nitrogen, etc. A fullscale effluent reclamation plant which is today supplying 1/3 of the water demand for the city of Windhoek utilized algae ponds and flocculation/flotation process. The quality of the finished water meets the requirements prescribed by the World Health Organization. Due to encouraging results obtained with the pilot plant study at Pretoria Municipal Sewage Disposal Works, a 1 mgd demonstration plant is being erected. One of the objectives of this experiment is to demonstrate to the public the possible reclamation of sewage effluents for domestic use and elimination of public prejudice and aesthetic objections. (See also W70-08864). (Hancuff-Texas)
W70-08869

HEALTH ASPECTS OF WASTE WATER REUSE,
Public Health Service, Dallas, Tex.
Charles W. Northington, Shih L. Chang, and Leland J. McCabe.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 49-56. 22 ref.

Descriptors: *Public health, *Water reuse, Research and development, *Infections, Toxicity, Tertiary treatment, Sewage treatment, Waste water treatment.
Identifiers: *Carcenogens.

A brief history is presented of the development of waste water reuse for domestic water supply and the need for waste water reuse research is emphasized. If the reuse of waste water for drinking purposes has really arrived there is a gross imbalance of the federal effort to study the health aspects. As an illustration the budget allowed for advanced waste treatment research approximately 8 million dollars in the fiscal year 1969 as opposed to the entire water hygiene research program of the Public Health Service for the same year of $537,800. The reuse of waste water is discussed from the standpoint of biological acceptibility as depicted by pathogens and parasites. The importance of consideration of low-level transmission of viruses by water is examplified by a 50 mgd supply which has a 99.99% reduction of virus typically reducing the count to 1 unit per 50 gallons; assuming 0.2% of the total supply is consumed as drinking water about 2,000 virus units will be swallowed daily by the people supplied with this water. Similar examples are given for bacterial infections, protozoan infections, and nematode and helminth infections. In addition studies are needed to determine the chronic toxicity, carcegonic effects, sex hormone effects and radioactive effects of waste water reuse. (See also W70-08864). (Hancuff-Texas)
W70-08870

WATER QUALITY REQUIREMENTS FOR RECREATION,
Wisconsin Univ., Green Bay.
Edward H. Storey, and Robert B. Ditton.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 57-63. 1 fig, 17 ref.

Descriptors: *Water quality, *Recreations, Ranges, Water reuse, Tertiary treatment, Waste water treatment.
Identifiers: *Threshold, *Criteria, *Variables, Requirements.

Recreation usage is the most rapidly growing demand on water. Studies conducted by the Outdoor Recreation Resource Review Commission in 1960 revealed that 40% of outdoor recreation participants favored water-based recreation activities over any others. Subsequent studies conducted by the Bureau of Outdoor Recreation have revealed that water-based activities are increasing sharply as evidenced by a 12% increase in fishing, an 18% increase in boating and a 15% increase in swimming during the half decade from 1960-1965, while population increased only 8%. Paradoxically as the nation's recreational demands upon water have increased, the suitability of the nation's resources to support water recreation activity has steadily deteriorated. The water quality variables effecting the ability to support or produce recreation include biological, chemical, and physical properties, each of which may induce a variety of psychological reactions. The psychological variables are broken into three categories: (1) The effective range is that quality of water which is not polluted sufficiently to influence the suitability of water for a specific recreational use. (2) The threshold is the minimum level at which water quality necessary to support a specific recreation. (3) The affected range is that range of quality within which the suitability of water for a specific use is deleteriously affected. Various references are cited in such areas as benefit cost analysis for water quality goals, requirements for body contact, recreational activities, and aesthetic acceptance of water oriented recreation. (See also W70-08864). (Hancuff-Texas)
W70-08871

REUSE OF WATER FOR THE PRODUCTION OF AGRICULTURE CROPS,
Texas Tech Univ., Lubbock.
Clark Harvey, Chester C. Jaynes, and Gerald W. Thomas.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 64-69. 1 tab, 20 ref.

Descriptors: *Water quality, *Productivity, *Agriculture, *Crops, Water reuse, Industrial waste, Surface runoff, Recharge, Lakes, Sewage treatment, Effluents.
Identifiers: *Criteria.

Sources of reuse water for the production of agricultural crops is reported for sewage effluent, industrial plant wastes, and surface runoff. The amount of sewage effluent discharged from municipal treatment plants in the United States on an average day has been estimated at 65,000 acre feet. Several examples are cited in which increased crop production was realized due to irrigation with sewage effluent for example grain sorghum yields were improved by sewage effluent (4,494 lbs/acre) over well water (3,572 lbs/acre) when each was used without additional nitrogen. Problem constituents of sewage effluents that may build up toxic levels in soils are dissolved solids, suspended solids, acids and metallic elements. Industrial waste is another source of reuse water that may be used in the production of agriculture crops. Examples are given of milk wastes, pulp mill and paper making wastes and paper board mill wastes. The southern High Plains of Texas constitute one of the major irrigated agriculture areas of the world. The Ogallala formation reservoir is hydrologically isolated and recharge can only come from precipitation. The High Plains area is characterized by numerous shallow undrained depressions or playas. Artificial groundwater recharge can be accomplished by injecting water collected in playa lakes into a multipurpose well. Groundwater recharge can conserve 75-80% of the water in the playa lake as compared with the 90% normally lost through evaporation. (See also W70-08864). (Hancuff-Texas)
W70-08872

TREATMENT OF WATER FOR BOILING AND COOLING PURPOSES,
Engineering-Science Inc., Arcadia, Calif.
Montague Blundon.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 70-79. 7 fig, 17 ref.

Descriptors: *Water reuse, *Water treatment, *Waste water treatment, *Boilers, Ion exchange, Water softening, Reverse osmosis, Electrodialysis, Cooling water, Filtration, Detergents, Alkylbenzene sulfonate.
Identifiers: Condensate, Removal.

To be suitable for conventional boiler make up, effluents from treatment processes, either municipal or industrial, must go through pretreatment for removal of troublesome constituents. Ammonia is corrosive to copper and copper alloys, and a number of treatment processes are given for its removal. Problems of phosphates stem from the possibility of the presence of orthophosphates reacting with residual hardness to form a hard scale. Household and industrial detergents may cause considerable problems with foaming, carry over and film boiling as well as fowling of ion exchange resins. A typical flow diagram of make-up treatment is presented and includes a cationic exchanger, degasifier, anion exchanger, and a mixed bed of cation and anion exchange material. Two other advanced processes that will undoubtedly soon find use in boiler feed water treatment include reverse osmosis, and electrodialysis. Evaporators are still a significant factor in feed water treatment field. Multi-stage flash evaporators produce excellent feed water. A short discussion is presented on condensate treatment. (See also W70-08864). (Hancuff-Texas)
W70-08873

UNITED STATES PRACTICES IN SEDIMENTATION OF SEWAGE AND WASTE SOLIDS,
Rex Chainbelt, Inc., Milwaukee, Wis.
Anthony Geinopolos, and William J. Katz.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 83-91. 5 fig, 18 ref.

Descriptors: *Sedimentation, *Settling basin, *Design, Equipment.
Identifiers: *Zone, Suspended solids, Loading, Retention time.

Fundamental to the process of sedimentation is the consideration of the character of suspended matter to be removed and the hydraulics of the basin in which solid-liquid separation is to be achieved. For example the suspended matter to be removed may range from discrete particles to flocculant materials may be settleable or floatable and may be present from low to high concentrations. Separation properties of solids therefore will depend on their type and character. Added to these difficulties is the effect hydraulic conditions have on solids removal by sedimentation basins. Included in a discussion of clarification equipment design is the size and shape of the basin, the inlet and outlet configurations, surface and solids loading, and hydraulic effectiveness as controlled by turbulence and short circuiting. An example of design is presented based on a complete examination of two criteria: overflow rate, and solids loading. (See also W70-08864). (Hancuff-Texas)
W70-08874

EUROPEAN PRACTICES IN SEDIMENTATION,
Emschergenossenschatt, Essen (West Germany).
Karl-Heinz Kalbskopf.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 92-103. 21 fig, 13 ref.

Descriptors: *Settling basins, *Performance, *Equipment, *Sedimentation, Flocculation, Efficiencies, Design, Costs.
Identifiers: *Loading, Europe, Practices.

A simple and economical method of separating settleable solids from liquids is of paramount operational importance to all mechanical, chemical, and biological processes applied in treating sewage. Over the years a great many different types of sedimentation units have been developed. The usual design factors do not cover all the complex physical and chemical processes that may take place in tanks when sewage and its solid particles float through the system. Most of the design data used ar e operating parameters established empirically. In Europe it is common practice to design sedimentation tanks with a certain detention period. The detention period chosen for domestic sewage range from 0.5 to 2.5 hours for primary sedimentation and 1.5 to 4 hours for secondary sedimentation. It is of utmost importance to acknowledge the fact that a very high efficiency can be reached only if optimum tank proportions are chosen with regard to hydraulic conditions. The usual design data determining the volume of a tank are: (1) the overflow rate ranging from 0.5 to 1.5 meters per hour in horizontal and 2.5 meters per hour in vertical flow tanks; (2) the solids loading (3.5 kilograms per square meter.hour in horizontal float tanks up to 7.5 kg/sq meter.hour in vertical flow; (3) the mean flow velocity (0.8 to 1.5 cm/sec) and (4) weir rates (5 to 20 cu meters per meter hour). Important design values for final sedimentation tanks are presented which include sludge volume index as a decisive influencing factor on the permissable solids loading. (See also W70-08864). (Hancuff-Texas)
W70-08875

SAND AND DIATOMITE FILTRATION PRACTICES,
Iowa State Univ., Ames.
E. Robert Baumann, and Charles S. Oulman.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 104-131. 19 fig, 2 tab, 20 ref.

Descriptors: *Filtration, *Diatomaceous earth, *Sands, Operations, Variability, Design, Pre-treatment, Particle size, Filters, Coatings, Headloss.
Identifiers: Polyelectrolytes.

Theoretical and empirical techniques for predicting filter performance have been developed and perfected. It will be necessary for engineers to continue to base filter design on experience. Several guides are presented for engineers designing granular filters. (1) Influent rate control has ma distinct advantages over effluent rate control variable declining rate system reduces headl required for flow control. (2) Dual or multi-me filters can significantly lengthen the run produce better water quality than a single medi Coated filters may be used as secondary filtrat media for polishing the effluent from granular ters. (3) Water pre-treatment control has an imp tant effect on filtrate quality. Polyelectrolytes improve effluent quality when added in very sn amounts to filter influent as it enters the filter b But polyelectrolyte can not substitute for adequ control of coagulant dosage and pre-treatment. Linear increase of headloss versus volume of trate should be the goal when filters are operate a constant rate. Convex filtrate curves of headl versus volume indicate surface rather than de removal of solids and higher filtration rates may needed. Concave filtrate curves of headloss ver volume indicate weak removal of solids and pot tial passage of turbidity during constant rate fil tion. (See also W70-08864). (Hancuff-Texas)
W70-08876

FILTRATION AND MICROSTRAINING SECONDARY EFFLUENT,
Metropolitan Sanitary District of Greater Chica Ill.
Bart T. Lynam, and Vinton W. Bacon.
In: Water Quality Improvement by Physical a Chemical Processes, University of Texas Pr Austin, 1970, p 132-148. 16 fig, 1 tab, 10 ref.

Descriptors: *Filtration, *Tertiary treatme *Evaluation, *Efficiencies, Headloss, Sands, Wa water treatment, Sewage treatment.
Identifiers: *Microstraining, Loadings, Suspend solids, Chicago (Ill).

A rational approach to the analysis of data relat to the performance of filtration devices in treat secondary activated sludge effluents to remo suspended solids is presented. In it should be co sidered suspended solids removal as a function suspended loading in terms of lb/sq ft/day. T takes into account the parameters of hydrau loading, in terms of gal/min/sq ft, solids input a the resultant effluent from the filtration process laboratory scale experiment is cited in which conditions of filtration are 200 gal/sq ft/hr (gal/min/sq ft) 36 inches of commercial grade 7- sand, solids in the media of 0.9 lb/sq ft/day wo apply within the constraint of a given sand type a operating head or when investigating a micr trainer the fabric size, operation of drum speed a head conditions. A comparison is present between a sand filter and microstrainer. The cost a 10 MGD plant is computed based on equivale results and loading. A cost differential of 0. cents/1000 gal (2.4 cents for sand filtration a 2.76 cents for microstraining) is calculat Microstrainers have advantage over sand filters that there is a low hydraulic head and minimu space requirement. (See also W70-08864). (Ha cuff-Texas)
W70-08877

HIGH-RATE SEDIMENTATION WITH TI TUBE CLARIFIER CONCEPT,
Neptune Microfloc Inc., Corvallis, Oreg.
Gordon Culp, and Walter Conley.
In: Water Quality Improvement by Physical a Chemical Processes, University of Texas Pre Austin, 1970, p 149-166. 11 fig, 1 tab, 15 ref.

Descriptors: *Sedimentation, *Settling basi *Tubes, *Filtration, Water treatment, Waste wa treatment, Sewage treatment, Turbidity.
Identifiers: Tube-clarifier, Mixed media filt Clarifiers, Theory, Polymers, Suspended solids.

Two basic settling tube systems are illustrated: t first is essentially horizontal, the second is steep inclined. The essentially horizontal tube settler used in conjunction with a filter and has its slud removed during the back wash cycle of the filter

ich time the tubes are drained and the sludge rried to waste. The water drained from the tubes replaced with the last portion of the filter ckwash water thus no additional water is lost due tube drainage and no mechanical sludge removal uipment is required. The steeply inclined tube tlers have continuous sludge removal achieved rough gravity settling (if the angle is in excess of deg). Practical applications for the tubes are scribed such as tertiary waste water treatment, d water treatment. Significant advantages are ined when considering hydraulic loadings. Conerably higher rates than permissible for convenal horizontal or upflow clarifiers are attained. ading rates of 3 to 5 gallons per minute per uare foot of tube entrance area are permissible ile limits of 1 gallon per minute per square foot e common for conventional flow clarifiers. Mixed edia filtration technology is also described. Conuration of the mixed media bed is such that more rticles can be stored before backwashing is quired. Installation of mixed media significantly creases the capacity of existing plants without anging their physical area. (See also W70-864). (Hancuff-Texas)
70-08878

GH-RATE FILTRATION OF INDUSTRIAL ASTES,
nbionic Designs, Inc., New York.
gene J. Donovan, Jr.
Water Quality Improvement by Physical and emical Processes, University of Texas Press, stin, 1970, p 167-189. 19 fig, 2 tab, 5 ref.

escriptors: *Filtration, *Industrial waste, *Waste ter treatment, Design, Pilot plants, Headloss.
entifiers: *Multi-media filters, Polymers, spended solids.

gh-rate, deep-bed, in-depth filtration has distinct vantages over ordinary techniques of chemical agulation and/or sedimentation for suspended lids removal. The required area for the treatment substantially less. The plants are constructed in odules which can easily be repeated to fit any w or design rate. Handling and feeding of bulk agulant chemicals is eliminated and disposal of sultant sludges minimized. The filter design rameters are tabulated and include effluent ality, influent characteristics, suspended solids, mperature, media characteristics, filtration rate, adloss and polyelectrolytes. Pilot plant tests were ade on a hot steel rolling mill discharge. A 2.3 m sand and 5.1 mm anthracite medium were used parately and then combined and tested many nes at various rates. The rate of 16 to 18 l/min/sq ft was selected to produce an effluent ss than 15 mg/l suspended solids consistently. A ll-scale plant was designed with 2 feet of sand der 5 feet of anthracite. Comparisons between e 6-inch test filter and a full-scale 225 sq ft filter it showed equivalent results. The filter is ckwashed through an air scour for 5 minutes at 8 m/sq ft and then flushed with water for 10 inutes at 30 gal/min/sq ft. The cost of an industri- waste filtration installation will vary with the aste flows, design rate, type of installation, neces- ry backwash and sludge handling facilities and cal cost factors. Rough costs are presented for avity-type concrete construction filter plants with dge thickener and vacuum filters included. (See so W70-08864). (Hancuff-Texas)
70-08879

LOTATION OF SEWAGE AND WASTE OLIDS,
ational Inst. for Water Research, Pretoria (South frica).
. J. Stander, and L. R. J. van Vuuren.
: Water Quality Improvement by Physical and hemical Processes, University of Texas Press, ustin, 1970, p 190-199. 4 fig, 3 tab, 8 ref.

escriptors: *Waste water treatment, *Floccula- on, *Coagulation, Sewage treatment, Industrial astes, Lime, Water softening, Chemicals.
Identifiers: *Flotation, Waste solids, Laboratory scale.

Flocculation/flotation is discussed as a unit process for separating coagulable suspended organic material from waste waters from fish and fishmeal processing plants, slaughter houses, primary clarified sewage, secondary effluents and oxidation and maturation pond effluents. Various flotation processes are essentially divided into two: dissolved air and dispersed air systems. The theory of dissolved air flotation provides for (1) adhesion of gas bubbles, (2) trapping of gas in floc structure as bubbles rise, (3) adsorption of gas bubbles as the floc structure is formed. Dispersed air systems are based on shearing actions of propellers or diffusion of gas through porous media to produce micro-air bubbles. For dissolved air systems bubbles of 80 microns usually exist while bubbles of 1000 microns are involved in dispersed air systems. In designing pilot scale flotation equipment laboratory investigation should first be conducted to establish criteria such as suitable flocculants, mixing conditions, aeration requirements and fluid velocities. Such surface active agents such as ABS or phospholipids appear to serve as activators for bubble attachment in flotation treatment of sewage and waste solids respectively. In the latter type of effluent sulfuric acid was most effective as a coagulant whereas excess lime showed definite advantages in treating sewage effluents. In laboratory scale investigations reductions of up to 70% in COD were achieved using sulfuric acid as a coagulant in fish factory and abattoir effluents. Removal of organic load with a laboratory flotation unit is tabulated for primary clarified sewage maturation ponds, slaughter house wastes, pulp and paper mill effluent and fishmeal processing effluents. (See also W70-08864). (Hancuff-Texas)
W70-08880

INTERFACIAL PROPERTIES ON OILY WATER CLARIFICATION,
Esso Research and Engineering Co., Florham Park, N.J.
Gerald P. Canevari.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 200-216. 11 fig, 9 ref.

Descriptors: *Oil, *Industrial waste, *Separation techniques, *Interfaces, Industrial water, Surface tension, Skimming, Waste water treatment, Equipment, Electrical stability, Stabilization, Chemicals.
Identifiers: *Surface active agents, Electrical double layer.

In most liquid-liquid dispersions there is one of three steps of the separation process that will usually be limiting. In sequence these steps are dispersed droplet collision, coalescence and finally settling. Techniques of separation are mainly directed at preferentially enhancing one of these steps, thus the identification of the limiting step for a given dispersion is a convenient means of characterizing the waste and selecting an appropriate separation technique. The significance of the drop size in oily water clarification problems can be considered as influencing the controlling parameter which is rise rate. The effect of interfacial properties on the rise rate of dispersed droplets is discussed and an example is given considering a liquid air interface. The presence of surface active agents has a major effect on the interfacial properties and the resultant ease of separation. The molecular structure of a surfactant determines its behavior at the interface, that is, orientation, concentration, adsorption rate and adsorption affinity. Although orientation of the surfactant at the oil water interface cannot be discerned, indirect evidence of its orientation can be observed by means of a hydrofilled balance. Other physical properties of significance in discussing oil water separation are viscosity of the continuous or external phase, the density difference between the oil phase and the water phase and the droplet diameter which is strongly influenced by interfacial forces. The influences of such items as suspended solids and the electrical double layer are discussed. (See also W70-08864). (Hancuff-Texas)
W70-08881

COAGULATION IN WATER AND WASTE WATER TREATMENT,
North Carolina Univ., Chapel Hill.
Charles R. O'Melia.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 219-236. 4 fig, 30 ref.

Descriptors: *Coagulation, *Colloids, *Translocation, *Electrical stability, Waste water treatment, Water treatment, Chemical adsorption, Flocculation.
Identifiers: *Polymers, *Destabilization, Electrical double layer.

When considering the theory of the practice of coagulation it is important to distinguish between two separate and distinct steps: (1) The particles to be aggregated must be able to adhere to each other when brought into contact (destabilization step is brought about by chemical coagulants); (2) Destabilized particles must be transported or brought into contact to effect the formation of larger particles. Three mechanisms of colloid destabilization are presented and discussed in detail. Destabilization may be accomplished by an indifferent electrolyte through compression of the electric double layer surrounding the colloidal particle, it may occur through neutralization of the charge on the particle by the specific adsorption of a coagulant of opposite charge or it may occur through the formation of a bridge through colloidal particles of a polymeric molecule. Destabilization in most conventional water and waste water treatment processes is accomplished by polymers. These polymers may be added directly to the process, may be produced within the process from salts added to the system, or may be produced directly within the system from substances present in the waste water. A summary of some evidence for this opinion is presented. Intraparticle destabilization can be accomplished in several ways. Three mechanisms are presented: (1) contact by thermal motion, (2) contacts resulting from bulk fluid motion, (3) contacts from settling of the particles. (See also W70-08864). (Hancuff-Texas)
W70-08882

PHOSPHATE PRECIPITATION,
Harvard Univ., Cambridge, Mass.
James O. Leckie, and Werner Stumm.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 237-249. 7 fig, 3 tab, 21 ref.

Descriptors: *Chemistry of precipitation, *Phosphate, *Solubility, *Kinetics, Hydrogen ion concentration, Nutrients, Chemicals, Phase diagram, Chemical precipitation.
Identifiers: Stoichiometry, Solid phase.

The continuous precipitation of phosphate in treatment of waste is a dynamic process and most likely equilibrium conditions are not attained; however, equilibrium considerations can aid attempts to understand the mode of phosphate removal. Furthermore, equilibrium calculations provide boundary conditions towards which the system must proceed. Formulation of the stoichiometry of the chemical reaction defined the minimum requisite quantity of chemicals. The stoichiometry and pH dependence is illustrated through the use of several solubility diagrams for iron phosphate and aluminum phosphate. The precipitation of phosphate with iron and aluminum is very fast; however, the rate of removal is controlled by agglomeration of colloids and by settling. Many factors may catalyze or retard the rate of precipitation. Flouride, even in trace concentrations enhances the rate of precipitation; while organic substances may act as crystal poison. Thus phosphorus removal is probably the most expensive step in treatment of waste. Design factors for phosphate removal plants

need to be based on pilot plant scale studies. (See also W70g08864). (Hancuff-Texas)
W70-08883

CHEMICAL OXIDATION AND REDUCTION,
Planidro, Sao Paulo (Brazil).
Max Lothar Hess.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 250-257. 4 fig, 8 ref.

Descriptors: *Chemicals, *Oxidation-reduction potential, Oxidation, Reduction (Chemical), Waste water treatment, Sewage treatment.

The knowledge of the redox potentials is important when considering the automatic operation of chemical oxidation and reduction processes. The transfer of electrons from one compound to another results in different potentials that can be measured by means of a potentiometer. In this the potential of an inert electrode immersed in a solution is compared with the potential of a reference electrode. The potential of the so-called Normal Hydrogen Electrode or NHE is assumed to be 0. Since the NHE is not suitable for practical use, other reference electrodes are commonly adopted. When considering waste water treatment, even the cheapest reductants and oxidants represent a considerable expenditure. Too main measures of economy should be kept in mind. (1) Segrating the waste that ought to be chemically treated from the other waste streams and (2) Monitoring redox potentials for excess reagent indicators. Common oxidants are discussed such as oxygen, chlorine, chlorous compounds, ozone and nitrates. Common reductants such as ferrous sulfate, sulfur dioxide, hydrazene, and iron are also discussed. Examples of chemical oxidation of waste waters are given for cyanides, cannery wastes and phenols. Examples of chemical reduction of waste waters are given for chromates, and decolorization of some synthetic dyes. All oxidation and reduction operations should be monitored to avoid finishing with an excess of oxidant or reductant which could be detrimental to receiving waters. (See also W70-08864). (Hancuff-Texas)
W70-08884

ION EXCHANGE FOR INDUSTRIAL WATER,
Rohm and Haas Co., Philadelphia, Pa.
Jerome G. Gaffney, Robert Kunin, and Donald G. Downing.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970. p 258-293, 16 fig, 9 tab.

Descriptors: *Industrial water, *Ion exchange, *Water softening, *Water quality, Cation exchange, Anion exchange, Desalination, Waste water treatment, Acid mine water, Tertiary treatment.
Identifiers: *Deionization, Regeneration, Trouble shooting.

There are two basic applications of ion exchange to the treatment of water in industry: water softening and water deionization. A discussion is presented on various ion exchange materials for water softening, as well as ion exchange resins involving the use of both cationic and anionic exchange. The measurement and effects of sodium leakage through a deionizing unit is discussed in regard to effluent quality. Choice of exchange resins is determined by the quality of water desired and costs involved. Discussion is presented on the removal of the various constituents such as free mineral acidity, carbon dioxide, silica and other various chemical constituents. Water desalination and renovation is discussed for the treatment of brackish waters in the 500-300 mg/l salinity range. A recently developed desalination technique utilizing ion exchange resins is described for this process. A combined ion exchange and coagulation process for treating acid mine drainage waters has been developed resulting in an effluent suitable for industrial, agricultural, or domestic usages. A modification of the process for treating acid mine waters can be employed as a tertiary sewage treatment process. The cost for treating secondary sewage effluent is only $0.15 to $0.20/1000 gal. Problems in water use in the industrial field may be encountered in four essential areas: (1) equipment, (2) operation, (3) exchange resin, and (4) influent changes. The important facits of these catagories are presented with illustrations of the major problems in each. (See also W70-08864). (Hancuff-Texas)
W70-08885

EXPANDED BED ACTIVATED CARBON ADSORPTION SYSTEMS FOR WASTE WATER TREATMENT,
Michigan Univ., Ann Arbor; and FMC Corp., Princeton, N.J.
Walter J. Weber, Jr., Charles B. Hopkins, and Ralph Bloom, Jr.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970. p 294-311, 11 fig, 1 tab, 17 ref.

Descriptors: *Activated carbon, *Tertiary treatment, Pilot plants, Organic compounds, Waste water treatment, Efficiencies, Mathematical model, Filtration.
Identifiers: Expanded bed, Packed bed.

A study is made directed towards field evaluation of expanded bed adsorbers which have certain potential operating advantages over packed-bed adsorbers for treating solutions which contain suspended solids. Chlorinated secondary effluent was used for the study. Experimental programs consisted of a 100 day comparative study of packed-bed and expanded bed modes of operation using 10-inch diameter steel columns with a total carbon depth of 12 feet. Both unfiltered and filtered secondary effluents were tested in paralleled operations. The sewage was comprised of approximately 25% industrial wastes 75% domestic waste. Secondary effluent was fed directly into two of the four adsorbers, white filtered secondary effluent was fed to the other two. All systems were operated at a loading of 5 gal/min/sq ft (2.72 gal/min). Filtration of the secondary effluent was accomplished with a 38 inch diameter cylindrical tank containing a 9 inch layer of anthracite coal (effective size 0.59 mm) and a 9 inch bed of filter sand (effective size 0.62 mm). Results of the study are presented graphically in terms of total organic carbon removal and soluble organic carbon removal versus volume of water treated. An expanded bed system can produce more treated effluent than an equivalent pack-bed system because of less down time for carbon cleaning operation. The elimination of frequent carbon cleaning results in a savings in operating labor for the expanded bed. For a 10 MGD plant the cost reduction probably would be about 0.1 cents/1000 gal. Pumping cost differences would be about 0.2 cents/1000 gal. (See also W70-08864). (Hancuff-Texas)
W70-08886

REVERSE OSMOSIS DEVELOPMENTS,
Santa Rosa Medical Center, San Antonio, Tex.; and Texas Univ., Austin.
David L. Goff, and Earnest F. Gloyna.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970. p 312-326, 9 fig, 2 tab, 33 ref.

Descriptors: *Reverse osmosis, *Operations, *Membranes, *Membrane processes, History, Mathematical model, Design, Desalination, Waste water treatment, Tertiary treatment.
Identifiers: Systems, Transport equation.

A historical development of the phenomenon of semi-permeable membranes and osmosis beginning with Abbe Nollet's observations in 1748 is presented. Some of the advantageous features that reverse osmosis offers as a separation process include: (1) Low energy requirements since phase changes are not required to effect the separation, (2) Simple and flexible operation, (3) Compa plant size. The heart of the process is a semi-perm able membrane. Although improved membran are being developed the modified cellulose aceta membranes have been forerunners in the reve osmosis process and have brought in process to t point where it merits practical consideration many water separation applications. A transp equation is developed based on a Fickian diffusi process. The solute transport is accomplished adsorption, diffusion, desorption process with d fusion assumed the rate controlling step. Vario operational considerations are presented. T physical and chemical degradation limit the use lifetime of the present day RO membranes to abo 6-12 months. Cost estimates for small brack water reverse osmosis plants are presented. For a MGD plant the total costs including plant amorti tion, membrane replacement, energy, operati and maintenance if $0.59/1000 gal. For the sa conditions a 10 MGD plant is $0.38/1000 gallo (See also W70-08864). (Hancuff-Texas)
W70-08887

THE APPLICATION OF MEMBRANES T SEWAGE AND WASTE TREATMENT,
Resource Engineering Associates Inc., Stamfo Conn.
Robert W. Okey.
In: Water Quality Improvement by Physical a Chemical Processes, University of Texas Pre Austin, 1970. p 327-338, 8 fig, 6 tab, 11 ref.

Descriptors: *Membranes, *Waste water tre ment, *Sewage treatment, *Tertiary treatment, * everse osmosis, *Membrane processes, Costs, I dustrial wastes, Pulp wastes.

Membrane filtration includes a broad range separation processes such as filtration, ultra-filtr tion, hyper-filtration, micropore-filtration, diff sion, and reverse osmosis. Generally, tho processes defined as super-filtration, hyper-filtr tion, and micro-filtration or the like refer processes in which discrete holes or pores exist in filter media and the efficiency of this type of filtr tion depends entirely on the difference of si between the pores and the particles to be remove The pores are generally in the order of 1000 100000 A and larger. Waste waters requiring trea ment frequently have a broad range of contamina size varying from ions to colloidal particles of up 1000 to 10000 A in their maximum dimensio Therefore, membranes employing both diffusi and pore flow have application in waste manag ment. Most membrane systems are designed in a s ries-paralleled layout in which the dilute proce stream passes through several parallel membra blocks or housing. This concept derives from t face that direct onflow systems tend to foul bad Operating characteristics are tabulated for an a tivated sludge membrane plant treating both ra sewage and secondary effluent. Extensive studi on the treatment of various pulping waste strea are discussed. In another extensive study of t removal of ions and organics (2000 mw) fro secondary effluents the separation required a fl value of 5 to 15 gpfd and an over pressure of 10 500 psi. Total cost is estimated at $0.40/1000 g for a 1 MGD facility and $0.30/1000 gal for a MGD facility. (See also W70-08864). (Hancu Texas)
W70-08888

GENERAL SLUDGE CHARACTERISTICS,
Engineering-Science, Inc./Texas, Austin.
Davis L. Ford.
In: Water Quality Improvement by Physical a Chemical Processes, University of Texas Pres Austin, 1970. p 341-357.

Descriptors: *Sludge, *Sludge treatment, Sedime tation, Heat balance, Chemical properti Vacuum drying, Centrifugation, Sewage treatmen Identifiers: *Sludge characteristics, Thickenin Vacuum filter, Flotation, Specific resistance.

tabulation of physical and chemical sludge haracteristics as reported from various sources is mmarized. Settleability of a sludge is discussed th emphasis placed on the limitations of the set- ng rate parameters. Specific resistance and com- essibility coefficients are defined and these haractertistics are tabulated for various sludges. A rtial tabulation of caloric heat value of sludges mbined with moisture content and percentage olatile and inert material is given. Chemical alyses of sludges are presented to illustrate the otential usefulness as fertilizers. The concentra- n of sludge nitrogen, phosphorus and potash ntent as well as organic fraction indicate the fer- izer value. Sludges are also described with spect to unit process performance. Sludge con- ntration and dewatering processes of gravity ickening, vacuum filtration, centrifugation, and otation are considered. (See also W70-08864). lancuff-Texas)
70-08889

HICKENING,
inois Univ., Urbana.
ichard I. Dick.
: Water Quality Improvement by Physical and hemical Processes, University of Texas Press, ustin, 1970. p 358-369, 7 fig, 18 ref.

escriptors: *Sludge, *Sludge treatment, *Sedi- entation, *Basin, Sewage treatment, Activated udge.
entifiers: *Thickening, Waste activated sludge, otation, Loading.

hickening is an important part of waste treatment stems because it accomplishes major sludge olume reductions at a low cost. Two basic types of ickeners are: gravity and flotation. Recent funda- ental advances in thickening have related mostly the gravitational type. The theoritical behavior sludges is relatively well understood and con- enient techniques are available for using nowledge of basic suspension settling properties r thickener design and for rational control of peration. Determining the required area and olume for thickening are interrelated. It is roposed that the area determination should be ased on a settling characteristic of the suspension hile volume determinations normally should be ased on the need for storing sludge during periods hen the solid feed rate exceeds the capacity of the hickener for passing solids. An illustrative problem presented and sample calculations are made to etermine the required area and volume for the hickening of 0.3 MGD of waste activated sludge rom an initial 2000 mg/l to 2% solids by weight. See also W70-08864). (Hancuff-Texas)
V70-08890

LUDGE FILTRATION AND SLUDGE CONDI- IONING,
exas Univ., Austin.
oseph F. Malina, Jr.
n: Water Quality Improvement by Physical and hemical Processes, University of Texas Press, ustin, 1970. p 370-387, 13 fig, 4 tab, 17 ref.

Descriptors: *Sludge, *Sludge treatment, Filtra- ion, Vacuum drying, Design, Sewage treatment, Waste water treatment, Acitvated sludge, Tem- erature.
dentifiers: *Vacuum filter, Sludge conditioning, Specific resistance.

The various factors which effect filtration of ludges can be catagorized in two major classes. The first characteristics of the sludge include: (1) hape and characteristics of solid particles in the ludge to be dewatered. (2) chemical composition f the sludge, organic or inorganic. (3) suspended olids content of the sludge (4) compressibility of olids in the sludge and (5) viscosity of filtrate and pecific resistance of the sludge. The first four of hese are fixed and very little can be done to alter hese characteristics. However, the viscosity of a iltrate as well as the specific resistance of the sludge can be altered by properly conditioning the sludge. Various aspects of sludge conditioning are presented and the effect of such conditioners as fly ash, newsprint, polymers and ferric chloride on specific resistance are presented. Results of this investigation show pulp newsprint at doses of 100-125% of the dry weight of the solids reduces the specific resistance of the activated sludge to a level equivalent to the minimum obtained with a cationic polymer with ferric chloride as a sludge conditioner. The effect of temperature on specific resistance of activated sludge was shown to have the least effect when utilizing pulp newspaper. The second category which effects filtration is the characteristics of the sludge dewatering system which include: type of filter medium used, size of pores, effects of solids, filter medium support, drainage system, operating pressure, contact time and final solids content of the cake. (See also W70-08864). (Hancuff-Tex)
W70-08891

CENTRIFUGATION,
Weston (Roy F.), West Chester, Pa.
J. H. Daugherty, and D. N. Bibbo.
In: Water Quality Improvement by Physical and Chemical Process, University of Texas Press, Austin, 1970. p 388-393, 1 fig, 2 tab.

Descriptors: *Sludge, *Sludge treatment, *Centrifugation, *Specification, Waste water treatment, Sewage treatment, Performance, Design, Activated sludge.

The three types of most widely used centrifuges in the field of waste water treatment are solid bowl, disc, and basket. Each perform one of three functions: clarification, classification or separation. Clarification is the process of removing the solids from a slurry phase where either the supernatant liquid or the solids are to be recovered. Classification is the process of removing solid particles of specific size from a liquid phase. Separation is the process of splitting a liquid into two fractions. In all three processes a difference in density must exist for the application to be feasible. In waste water treatment primary interest is in clarification or the removal of solids from a sludge or slurry, thereby reducing the volume for easier disposal. Centrifuges have been used extensively in the dewatering of primary, secondary and combined sludge and for oil recovery, slime sludge dewatering and by-products recovery. The solid-bowl machine is generally best suited for dewatering the solids involved in primary clarification. Centrifuges operating on primary sludge and achieving greater than 90% solids recovery have a cake discharge with a solids content of about 20 to 25%. Suggestions are given for specifications and information which may be presented to the equipment manufacturers when selecting a centrifuge for a specific use. (See also W70-08864). (Hancuff-Texas)
W70-08892

DISPOSAL OF SLUDGE ON LAND,
Texas Univ., Austin.
Ben B. Ewing, and Richard I. Dick.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970. p 394-408. 4 fig, 6 tab, 33 ref.

Descriptors: *Sludge, *Sludge disposal, *Fertilizers, Operations, Chemical properties, Diseases, Nutrients, Heavy metals, Costs.
Identifiers: *Landfill, Nuisances.

Sludge disposal on land may be applied as undigested primary, as excess activated sludge, or as digested sludge. It may be applied as a liquid or it may be dewatered or dried. The land may be used simply as a site for stockpiling sludge for storage. Sludge has long been applied to land for land improvement using the humus and the nutrients in the sludge for soil conditioning. Recently interest has been sparked in use of land application of liquid sludge as a means of sludge treatment and disposal. This practice also used the water for irrigation. If land disposal is compared with other sludge treatment and disposal costs instead of considering sludge in economic competition with chemical fertilizers as a means of increasing a crop production, it becomes economically attractive. Chemical composition of sewage sludge is also tabulated being broken down into total nitrogen varying from 1.81 to 5.96% total phosphate P2O5 varying from 1.16 to 6.97% total soluble K2O varying from 0.29 to 0.56% and ash varying from 27.7 to 61.4%. Odors, flies, and aesthetic degradation of the neighborhood seem to be the complaints most often voiced. Various costs are given including costs of transportation of sludge from the city by railroad tank car, tank truck, pipeline. In addition the cost of sludge disposal by various methods is presented for land application of liquid, digested sludge, dewatered sludge to landfill, fertilizer production, incinerator ash to landfill. (See also W70-08864). (Hancuff-Texas)
W70-08893

INTERRELATIONSHIP AND SLUDGE SEPARATIONS,
Texas Univ., Austin.
James Barnard, and W. Wesley Eckenfelder, Jr.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970. p 409-420, 6 fig, 7 tab, 12 ref.

Descriptors: *Sludge, *Sludge disposal, Mathematical model, Dewatering, Centrifugation, Vacuum drying, Sewage treatment, Waste water treatment, Industrial wastes.
Identifiers: *Interrelationships, *Sludge handling, Flotation, Thickening, Loading, Vacuum filter.

Increasing urbanization and decreasing land availability is placing increasing emphasis on concentration and dewatering of sludges for incineration or local land disposal. In order to attain the lease-cost solution for sludge treatment and disposal the interrelationships between treatment alternatives are of prime importance. Mathematical process models can be employed to relate cost to unit size, unit size to quality of product, and thus generate an optimization procedure for sludge treatment. The characteristics of a sludge vary with both the source, i.e., industrial or municipal and with the treatment process employed, i.e., physical, chemical or biological. These variations dictate the choice of treatment sequence. The major sludge treatment units discussed for the handling of primary and secondary sludge include flotation thickener, gravity thickener, aerobic digester, anaerobic digester, centrifuge, vacuum filter, drying beds, incineration, and land fills. The economics of each unit in the sludge treatment sequence has some effect on or is itself effected by other treatment units. The thickening of sludges prior to dewatering in a vacuum filter or centrifuge to treatment in biological units or to barging or piping to disposal has perhaps the highest benefit to cost ratio of all the units. Mathematical models are developed for flotation thickening, gravity thickening, sludge dewatering, centrifugation, and vacuum filtration. (See also W70-08864). (Hancuff-Texas)
W70-08894

EUROPEAN PRACTICES IN SLUDGE DEGESTION AND DISPOSAL,
Wolfgang A. G. Vater.
In: Water Quality Improvement by Physical and Chemical Processes, University of Texas Press, Austin, 1970, p 421-436. 11 fig, 3 tab, 11 ref.

Descriptors: *Sludge, *Sludge disposal, *Sludge digestion, Costs, Performance, Centrifuge, Vacuum drying, Dewatering, Incineration.
Identifiers: *Europe, Drying beds, Sludge handling, Pasteurization, Thickening, Vacuum filter, Filter presses.

European practices in sludge dewatering and disposal are discussed considering those aspects which differ from methods presently used in the United States. The differences between European

and American sludge disposal practices are primarily the result of cost differences. Power costs for municipal utilities is 2.5 cents/kw hr, current self-generated from digester gas 1.2 cents/kw3hr, fuel oil $0.10/gal, construction and installation costs for digesters is approximately $50/m3 and labor is about $4000/yr. Pasteurization prior to use on the soil is required if the sludge is to be used for improvement of the soil. Composting with refuse in which sufficient self-heating is generated is considered an effective heating of the liquid. Most sludge thickeners are tanks with circular cross sections. If they are not equipped with the scrapers the bottom is funnel shaped with sludge removal at the deepest point. Continuous decanter centrifuges are most commonly used. If no chemicals are added the recovery is 40-70% of solids from the raw sludge. The average vacuum filter rate is about 5 gal/sq ft and under favorable conditions up to 7.5 gal/sq ft for solids content of 10%. Of all available mechanical sludge dewatering equipment filter presses yield the greater possible cake solids content. The average performance is about 1 to 2.5 gal/sq ft with solids content of 10% and cake solids content of 40-60%. Sludge incineration yields the smallest possible final volume of any mechanical sludge handling method. Incinerators of the multiple hearth furnace and fluidized bed type are discussed. (See also W70-08864). (Hancuff-Texas)
W70-08895

THE UTILIZATION OF THIOCYANATE BY A HETEROTROPHIC BACTERIUM,
University Coll. of South Wales and Monmouthshire, Cardiff.
D. A. Stafford, and A. G. Gallely.
Journal General Microbiology, 55, Part 1, p 285-289, 1969. 3 fig, 8 ref.

Descriptors: *Activated sludge, *Biodegradation, *Incubation, *Isolation, *Assay, Dentrification, Inhibition, Phenol, Nitrogen.
Identifiers: *Autotrophs, Sterilization, Pseudomonad, Cellular nitrogen, Thiobacilli.

A heteorotrphic bacterium is isolated by plating out on a solid thiobacillus-enrichment medium. Characteristics of the organism given include: (1) rapid positive result in the oxidase test utilizing denitrification as an anaerobic respiratory mechanism. (2) no growth took place on nutrient agar at 4 over a period of ten days. (3) pigment is not produced under any conditions of growth. (4) the organism used thiocyanate as sole source of cellular nitrogen and sulfur. In the presence of excess thiocyanate, growth stopped suddenly whenever the carbon and energy source were exhausted. The organism fits the definition of pseudomonad. Characteristic features of the organism are its rough and smooth colonial variations. The potential use of the organism in the biological treatment of effluents is brought out by its ability to metabolize both phenol and thiocyanate simultaneously. (Radhakrishnan-Texas)
W70-08896

SEWAGE TREATMENT PLANTS,
Nebraska Univ., Lincoln.
Leon S. Directo.
Water and Sewage Works, Vol 116, No. 8, Aug 1969, p 289-296. 7 fig, 5 tab.

Descriptors: *Waste water treatment, *Sewage treatment, *Plants, *Organic loading, Biochemical oxygen demand, Trickling filter, Operation, Efficiency, Performance, Ponds, Stabilization, Lagoons, Sampling, Nebraska.
Identifiers: *Hydraulic loading, *Suspended solids, Aerated lagoon, Recommendations.

The purpose of the paper is to determine and compare organic and hydraulic loadings on each of the sewage plant components (selected in Nebraska) with design loadings and to evaluate the removal efficiencies of the plant components in terms of BOD and suspended solids (SS) and evaluate general operation of each treatment system. The evaluation program consists of three phases namely: preliminary office planning, field inspection, and actual field sampling and testing. A particular plant, plant A is discussed for its inability to produce a satisfactory effluent. The plant is being loaded with an organic load (from cheese factory) of about 4 to 5 times the design value. Alternative methods are recommended to eliminate the inefficiency. In the case of another plant, plant B, the loadings were found to be 50% of the designed value. The data obtained reflects climatic condition existing at the time of sampling. As regards plant C, which consists of aerated lagoon followed by stabilization pond, the overall removal efficiency was about 88% for BOD and 65.1% for suspended solids. For plant D a low-rate trickling filter, both hydraulic and organic loadings were below the design value. Plant E, a high-rate single stage trickling filter had overall removal efficiency of 85% for BOD and 99% for SS. (Shankar-Texas)
W70-08897

A STANDARDIZED PROCEDURE FOR THE DETERMINATION OF DEHYDROGENASE ACTIVITY IN SAMPLES FROM ANAEROBIC TREATMENT SYSTEMS,
Middle East Technical Univ., Ankara (Turkey).
G. Lenhard.
Water Research, Vol 2, No 2, p 161-167, February 1968. 7 fig, 1 tab, 19 ref.

Descriptors: *Denitrification, *Anaerobic digestion, Temperature, Sludge, Digestion, Activated sludge, Waste water treatment, Sewage treatment.
Identifiers: *Dehydrogenase activity, Biochemical process, Reaction time, TTC concentration, Standardized method.

The applicability was studied of the dehydrogenase activity method for assessment of anaerobic treatment systems activity. The biochemically active sludge used for the tests was taken from two anaerobic digesters, one in which the denitrification activity was high. The results showed that (a) the optimum pH is identical with that for aerobic activated sludge systems, (b) linearity exists between dehydrogenase activity and sample quantity on the one hand and time on the other for both strongly and weakly active sludges tested, (c) the optimum temperature is 37C which is the same in aerobic systems, and (d) the optimal, final triphenyl tetrazolium chloride (TTC) concentration is 0.1%. The dehydrogenase activity method originally developed for soils and solid waste materials is also applicable to the study of anaerobic treatment systems like the one demonstrated. In special cases of anaerobic fermentation, care should be taken to insure that triphenyl formazan (TF) formation is biochemical by testing for factors characteristic of enzyme kinetics. (Shankar-Texas)
W70-08899

THE RELATION BETWEEN SLUDGE VOLUME INDEX AND SLUDGE CONTENT IN THE ACTIVATED SLUDGE PROCESS,
Instituut voor Gezondheidstechniek TNO, Delft (Netherlands).
J. A. Somers.
Water Research, Vol 2, No 5, p 563-573, May 1968. 7 fig, 2 tab, 5 ref.

Descriptors: *Sludge, *Activated sludge, Sedimentation, *Sludge treatment, Sewage treatment, Waste water treatment.
Identifiers: *Sludge volume index, *Sludge content, Variation, Bulking sludge, Vessel diameter, Grain diameter, Flow velocity, Pore volume.

To characterize the sedimentation properties of activated sludge in the activated sludge treatment process, the determination of the sludge volume index (SVI) is important. Experiments were conducted in the oxidation ditch at Oudewater. A slow rise of SVI 45-55 to 70-90 was noted during the years 1962-1964. It is felt that the wide divergence may be due to inhomogeneities in the settling sludge mass and varying sludge qualities in t period of two years. Experimental methods we adopted to determine the SVI by artificially varyi sludge contents. The results from Oudewa showed that SVI increases as the sludge content creases. However, for the highest sludge content lower SVI was noted. Sludge from Sancta Ma (plant with bulking sludge) showed a differe result. In this case SVI was lower when the slud content was higher. Interpretation of the resu from different sludges pointed that the diameter the settling glass might influence SVI. (Shank Texas)
W70-08900

INSTRUMENTATION FOR HYDROGEN SU FIDE MEASUREMENTS,
Los Angeles Bureau of Sanitation, Calif.
William F. Garber, Joe Nagano, and Frank F. Wada.
Journal Water Pollution Control Federation, P II, R209-R220, May 1970, Vol 42, No 5. 10 fig, ref.

Descriptors: *Instrumentation, *Hydrogen sulfi *Measurements, *Analysis, Testing, Waste wa treatment, Sewage, Test procedures, Volumet analysis, Sewage treatment.
Identifiers: *Detection, Inorganic sulfide.

The generation and release of hydrogen sulfic with subsequent odor and corrision problems is factor of concern in almost all waste water systen but particularly in areas where organic strength high and average waste water temperatures exce 70 to 72 deg F. Although previous work provid considerable insight into the mechanisms of sulfi generation and release studies of these speci problems require extensive action and continuo testing capabilities. A number of sulfide te procedures have been developed over the yea Each of these has been of value under certain co ditions and in fact often satisfying needs for port bility, low initial cost and spot testing as well as t more sophisticated continous operation. Howeve in depth studies ultimately require accurate, aut mated continuous testing capability. For contin ous measurement a lead acetate tape an early co lometric instrument and the present coulomet instrument capable of both liquid and gaseo phase analysis has been examined. The improv automated lead acetate method has had wide a plicability where the concentration range was pr dictable, and specific reaction with hydrogen su fide was important; however, the current coulome ric method appears to be the most accurate. (Ha cuff-Texas)
W70-08902

KITCHENER PRE-TREATMENT PLAN REDUCES CITY LOADING BY 20%,
Reid, Crowther and Partners Ltd.
R. R. Parker.
Water and Pollution Control, Vol 108, No 3, p 1 19, March 1970. 1 fig.

Descriptors: *Waste water treatment, Industr wastes, Flotation, Sedimentation, Screens, Far wastes.
Identifiers: *Meat packing wastes, Manur Kitchener (Ontario, Canada).

The J. M. Schneider, Ltd. operates a meat packi plant which kills and processes cattle, hogs, a poultry and produces both fresh and cook products. Its waste water streams total 1.4 MG with up to 27,000 lbs BOD, 20,000 lbs suspend solids, and 12,000 lbs ether solubles. The City Kitchener, Ontario requested this waste load reduced to 900 ppm BOD, 600 ppm suspend solids, and 200 ppm ether solubles, based on average of the consecutive 24 hour composite sa ples. The company installed two sewers, one co taining fat bearing waste water (95% of the to flow) and the other containing manure bearin wastes. Sanitary sewage and storm sewage go city facilities through existing lines. The fat bearin

stream is passed through a vibrating 1/4 inch mesh screen where large particles are removed. The effluent goes into an equalization tank and then into a combination flotation-sedimentation unit. Grease is removed by flotation, solids by sedimentation. Manure bearing wastes are screened on 100 mesh vibrating screens. Effluent from both streams goes to municipal sewers. Screenings are taken to landfill. The grease disposal problem remains unsolved. The units involved in both treatment plants are discussed in detail. The City of Kitchener treatment plant reported a 20% reduction in the loading on its plant after the meat-packing plant installed its own treatment plant facilities. (Makela-Texas)
W70-08903

ALGAL FLOCCULATION WITH ALUMINUM SULPHATE AND POLYELECTROLYTES,
New South Wales Univ., Kensington (Australia).
Michael G. McGarry.
Journal Water Pollution Control Federation, Part II, p R191-R207, May 1970, Vol 42, No 5. 6 fig, 4 tab, 14 ref.

Descriptors: *Algae, *Flocculation, Equipment, Costs, Separation techniques, Coagulation, Waste water treatment.
Identifiers: *Alum, Polyelectrolytes, Factorial design.

The high rate pond process is being developed to treat waste water and to provide a new source of edible protein in the form of algae. As a food production process, the yield of algae exceeds the yields of all currently known grain crops. Recent studies in Thailand have indicated that protein production rates of 25 tons/year/acre are quite easily acheived on a pilot plant scale. This yield compares favorably with that of wheat, 135 lb/year/acre and that of soy beans 576 lb/year/acre. Aluminum sulfate was tested as a primary coagulant in conjunction with a variety of polyelectrolytes for chemical flocculation as a means of harvesting the dispersed algae from heavily laden pond water. The independent variables studied were alum and polyelectrolyte concentrations, time of polyelectrolyte addition, fast and slow mixing period and degree of turbulence. Dependent variables considered were: supernatant transmission and settled volatiles as a measure of harvest of algae, after one hour of settlement. Cost of algal havesting by alum alone at concentrations of 30 mg/l would be prohibitive. The overall minimum cost per unit of algal yield was attained with alum along at dosage range of 75 to 100 mg/l of alum. (Hancuff-Texas)
W70-08904

AUTOMATIC ASSESSMENT OF RESPIRATION DURING GROWTH IN STIRRED FERMENTORS,
Shell Research Ltd., Sittingbourne (England).
Douglas W. Ribbons.
Applied Microbiology, Vol 18, No 3, p 438-443, Sept 1969. 8 fig, 19 ref.

Descriptors: *Respiration, *Fermentation, *Oxygen demand, *Dissolved oxygen suspensions, Environment, Methane, Viability, Growth chambers.
Identifiers: *Stirred fermentors, *Glucose limiting media, *Dissolved oxygen electrode, *Oxygen uptake, Thermotolerent bacterium, Gaseous exchange.

Continuous measurement of respiration during growth of microorganisms is a valuable information in understanding the growth culture. An apparatus for continuously recording respiration is described. All the other methods are briefly explained. A comparison of the present method is made with the other methods and the advantages are brought out. The apparatus is primarily used to investigate gaseous exchange that occurs during bacterial growth. Respiration of Escherichia coli, Pseudomonas aeruginosa, Bacillus Thuringiensis and Methylococcus capsulatus are measured during growth on complex and defined media. Results of the study of P. aeruginosa in ammonium limited media and glucose limited media are compared. Data obtained are not used for establishing any quantitative relationships but to understand the growth process. (Radhakrishnan-Texas)
W70-08905

AERATION ON AN INCLINED TRANSVERSELY CORRIGATED SOLID SURFACE,
Louisiana Polytechnic Inst., Ruston.
H. K. Huckabay, and Arthur G. Keller.
Journal of Water Pollution Control Federation, Part II, p R202-R208, May 1970. 4 fig, 10 ref.

Descriptors: *Aeration, *Mathematical model, Industrial waste, Sewage treatment, Waste water treatment, Corrigated metal, Aerator, Fluid dynamics, Inclination, Metal sheet.

Gravity flow down an inclined transversely corrigated solid surface appears to be a method of aeration deserving of wide-spread consideration. The experimental apparatus used in this study was corrigated galvanized iron with sinusoidal characteristics of 1.25 inches amplitude. The cascade board was varied from an inclination of 5 to 30 deg from the horizontal. The range of water temperature studied was from 28 to 42 deg C. Water flow rate was varied from 0.02 to 0.08 million gallons/day/foot width. By standard statistical techniques it was determined that K sub la, the coefficient of mass transfer, was a function of the angle of inclination and throughput and N sub t, the number of transfer units, was a function of the angle in inclination only. The transfer unit is independent of flow-rate and implys the ability of the cascade to undergo large-scale surges in volumetric input without a change in aeration performance. (Hancuff-Texas)
W70-08906

COMPARISON OF WASTE WATER SAMPLING TECHNIQUES,
Southwest Research Inst., San Antonio, Tex.
D. S. Tarazi, L. L. Hiser, R. E. Childers, and C. A. Boldt.
Journal of Water Pollution Control Federation, Vol 42, No 5, Part I, p 708-732, May 1970. 10 fig, 11 tab, 6 ref.

Descriptors: *Sampling, *Statistics, *Monitoring, Waste water treatment, Automation, Analytical techniques, Statistical method, Probability, Evaluation.
Identifiers: *Sampling techniques, *'T' tests, Grab samples, Waste water characteristics.

A significant difference exists between the data obtained by grab sampling and by flow-weighted composite sampling. The significance of these differences was mainly dependent on the following factors: (1) the overall time period for which the waste water is to characterize, i.e., whether daily or other time increments of pollution loading are to be determined, (2) the confidence levels desired, (3) the variability of both quality and quantity in the specific waste water stream, and (4) whether concentration levels or material transport rates are desired. A comparison is made between grab samples and weighted composites for several industries on the Houston ship channel. From past experience that the number of grab samples required to be equivalent even with 90% confidence limits to a flow-weighted composite is excessive for most of the waste water entering the ship channel. Two waste water streams were utilized in this demonstration. Daily composite and grab samples were taken from both flows. Analyses determined on the first included pH, total residue, filtered COD, TOD, total filtered carbon, and inorganic filtered carbon. The second stream included only total, filterable and non-filterable residues. The 'T' test is used to statistically analyze the collected data and develop confidence limits. (Hancuff-Texas)
W70-08907

SCUM INCINERATION EXPERIENCES,
East Bay Municipal Utility District, Oakland, Calif.
Elmer E. Ross.
Journal of Water Pollution Control Federation, Vol 42, No 5, Part I, p 733-736, May 1970. 1 fig, 3 tab.

Descriptors: *Scum, *Incineration, *Operation and maintenance, *Skimming, Sewage treatment, Waste water treatment, Sediments, Oil, Sludge disposal, Costs, Air pollution, California.
Identifiers: *Experiences, Gas analysis, Non-digestable, Gravity flotation, Oakland (Calif).

The East Bay Water Pollution Control system of Oakland, California is designed to give primary treatment to an average dry weather flow of 128 MGD and handle a maximum of 291 MGD. The treatment process consists of pre-chlorination, screening, grit removal, sedimentation, post-chlorination and sludge digestion. During the early years of operation it was found that the sedimentation tank scum which was then pumped to the digestion system with raw primary sludge contained appreciable amounts of petroleum oil, and other industrial wastes which were not readily digestible. This problem initially lead to the installation of a gravity flotation type thickener in which the raw skimming and digestion scum were concentrated and hauled to off-plant sanitary fills. The high cost of this method of disposal, in excess of $12,000 annually for hauling alone resulted in the installation in 1964 of an incineration plant. The 10.75 ft. 6-hearth unit is designed for 20 ton/day and automatic operation to minimize operator attention. To meet the air pollution control district standards the furnace was equipped with a Venturi-type wet scrubber and cyclonic separator. The heat value of the scum on a dry basis is between 14,000 and 16,000 BTU's/lb. Moisture content varied from 48.6% to 42.5% in 1968. The maximum temperature maintained within the furnace varies from 1500 to 1800 deg F. (Hancuff-Texas)
W70-08908

THE USE OF FLY ASH IN WASTE WATER TREATMENT AND SLUDGE CONDITIONING,
Cincinnati Univ., Ohio.
J. David Eye, and Tapan Kumar Basu.
Journal of Water Pollution Control Federation, Vol 42, No 5, Part II, p R125-R135, May 1970. 4 fig, 9 tab, 8 ref.

Descriptors: *Sludge, *Fly ash, *Waste water treatment, Sludge disposal, Sewage treatment, Filterability, Laboratory tests, Costs, Chemical oxygen demand.
Identifiers: *Sludge conditioning, Settleability, Suspended solids.

Fly ash is capable of reducing COD of a secondary effluent by about 30% at a fly ash concentration of about 1600 mg/l when the initial COD is around 60 mg/l. The removal of suspended solids containing fly ash by coagulation with lime is highly efficient. With an overflow rate of 330 gal/day/sq ft about 98% of the suspended solids were removed. Fly ash is a useful agent in conditioning sludge prior to vacuum filtration. Although fly ash has the great advantage of being very cheap and readily available in most industrial areas an additional initial expenditure is required for suitable mixing and feeding equipment for fly ash use in an existing plant using conventional methods of sludge conditioning. Characteristics of fly ash are presented and its usefulness described. It weighs 30 lb/cu ft, has a carbon content of 1 to 60%, a specific gravity of 2.1 to 2.55 and specific surface area of 2,970 and 6420 sq cm/gm. (Hancuff-Texas)
W70-08909

CLARIFICATION-ADSORPTION IN THE TREATMENT OF MUNICIPAL AND INDUSTRIAL WASTE WATER,
Calgon Corp., Pittsburgh, Pa.
D. G. Hager, and P. B. Reilly.
Journal of Water Pollution Control Administration, Vol 42, No 5, p 794-800, May 1970. 9 tab, 4 ref.

Descriptors: *Adsorption, *Waste water treatment, *Sewage treatment, *Activated carbon, *Costs, Industrial wastes, Performance, Biochemical oxygen demand, Reliability.
Identifiers: Requirements, Total organic carbon.

Over the last three years many laboratory and field evaluations have confirmed the technical and economic feasibility of treating raw municipal waste water with granular activated carbon after preliminary flocculation and settling to reduce suspended solids. Adsorption isotherm studies were conducted on raw waste water from 11 municipal plants located principally in Western Pennsylvania. The results of these tests are tabulated in terms of total organic carbon. The pounds of carbon required to treat waste water are shown as pounds per million gallons and indicate a wide range between 542 and 4280 for 90% TOC removal and between 572 and 5050 for 95% TOC removal. It is stated that the break even point when comparing economics of activated sludge and activated carbon is a carbon dosage of 300 to 1000 pounds per million gallons. A cost comparison is given between the activated sludge system for 10 MGD plant at 90% BOD removal and the clarification-adsorption process for 95% removal. The activated sludge plant construction cost is estimated at 3.883 million dollars as compared to 3.359 million dollars for adsorption-clarification plant. A summary of the operating costs of the two systems is tabulated. A total of $0.091/1000 gallons is presented for the activated sludge system and $0.107/1000 gallons for the clarification-adsorption system. Combining operating costs with amortization of capital the two systems are essentially identical amounting to $0.178/1000 gallons for activated sludge and $0.179/1000 gallons for clarification-adsorption. (Hancuff-Texas)
W70-08910

THE MANNING EQUATION AND BOUNDARY RESISTANCE,
Guelph Univ. (Ontario).
Peter S. Chisholm, and G. Tsang.
Journal of Water Pollution Control Federation, Vol 42, No 5, Part 1, p 753-757, May 1970. 2 fig, 7 ref.

Descriptors: *Sewers, *Manning's equation, *Variability, Evaluation, Pipes, Flow, Flow rates, Friction, Hydraulic gradient, Design, Reynolds number.

Contrary to Manning's (Trans. Inst. Civil Eng Ireland: 2021, 1889) original conclusions n is not a function of boundary roughness alone. Within the design range selected for illustration n increases with increasing conduit size and effective roughness and decreases with the Reynolds number. The selection of correct effective roughness value for design is important to correct assessment of boundary resistance to flow. Available data illustrate that effective roughness of concrete-walled conduit is between 1 and 2 orders of magnitude less than values often attributed to that material. For example, the roughness value recommended for concrete ranges between 0.001 and 0.01 feet. Available experimental data indicate that the range for pre-cast sewer pipe with average field joints is between 0.00015 to 0.00023 feet. Resistance to flow due to factors other than wall roughness must be accounted for in design; thus the values of n often are modified to account for both predictable and anticipated field conditions. (Hancuff-Texas)
W70-08911

OPERATOR DEVELOPMENT--PACIFIC NORTHWEST,
Washington State Water Pollution Control Commission, Olympia.
Russell K. Taylor
Journal of Water Pollution Control Federation, Vol 42, No 5, Part I, p 704-707, May 1970.

Descriptors: *Training, *Education, Operation and maintenance, Sewage treatment, Waste water treatment, Personnel, Permits
Identifiers: *Operators, *Certification, Incentives, Personnel development.

The Pacific Northwest has seen many changes and developments in the municipalities responsibility for maintaining water quality standards. The effects of these changes on water pollution control plant operators is evaluated and the outlook for the operator of tomorrow is assessed. Comments are made with reference to Washington State, but these comments reflect the activities in each state of the Pacific Northwest. In its solutions to the many problems associated with water pollution, Washington State Water Pollution Control Commission has adopted a regulation and a plan of implementation for interstate, intrastate, and coastal waters for the protection and maintenance of water quality in the State of Washington. In order to accomplish these goals, there is a need for training 490 pollution control plant operators by 1974. The training needs of the State of Washington exist in four areas: (1) Preparatory training, (2) Skill maintenance, (3) Skill improvement, (4) Emergency training. The operators of the State of Washington have participated in a voluntary certification program for several years and to date there have been 516 certificates of competency issued by the State Certification Board. Of these there are more than 400 active certificates held in industry. The Washington State Department of Health has drafted a mandatory certification bill for water works and for water pollution control plant operators which is anticipated to be considered by the 1971 legislature. (Hancuff-Texas)
W70-08912

AN EVALUATION OF THE STANDARD BIOCHEMICAL AND ELEVATED TEMPERATURE TESTS FOR DIFFERENTIATING FAECAL AND NON-FAECAL COLIFORMS,
Central Public Health Engineering Research Inst., Nagpur (India).
R. P. Mishra, S. R. Joshi, and P. V. R. C. Panicker.
Water Research, Vol 2, p 575-585, 1968. 4 tab, 29 ref.

Descriptors: *Coliforms, *Evaluation, *Laboratory tests, Sewage bacteria.
Identifiers: *Biochemistry, Differentiation.

The relative efficacies of the biochemical IMViC and the elevated temperature (FC) tests have been compared for differentiating the faecal and non-faecal coliforms. Altogether 1628 coliform strains comprised of 427 from 143 samples of human faeces, 301 from 101 samples of cattle faeces, 631 from 113 samples of sewage and 269 from 120 samples of soil were classified as to their IMViC types and response to elevated temperature reactions. Parr's Escherichia group (++--, +--- and -+--) was represented by 83 and 85% of the coliform strains isolated from human and cattle faeces respectively. Of the coliform strains isolated from human cattle faeces 82.0 and 76.4% respectively were found positive for the FC test. Neither the IMViC nor the FC tests by themselves can be considered adequate for differentiating coliforms of faecal and non-faecal origin. (Aguirre-Texas)
W70-08913

MANPOWER CRISES LEADS TO PROGRAMS FOR TRAINING POLLUTION-ABATEMENT TECHNOLOGISTS,
Charles County Community Coll., La Plata, Md.
Carl M. Schwing.
Water and Wastes Engineering, Vol 1, No 3, Mar 1969, p 56-58.

Descriptors: *Education, *Personnel management, Pollution abatement, Training, Waste water treatment, Maryland.
Identifiers: La Plata (Md).

Personnel at Charles County Community College, La Plata, Maryland, have developed a program to provide training for individuals in pollution abatement technology. The FWPCA has estimated a need for 18,500 trained waste water treatmen plant operators over the next five years, with an ad ditional 23,000 trained technicians. The colleg program includes: (1) an annual training course fo treatment plant operators already in the field, (2 professional seminars for operators, (3) a two-yea Associate of Arts degree in pollution abatemen technology leading to employment in supervisor or technicial positions in operating or regulator agencies or in industry. The facilities at the colleg include a $1.2 million science and technolog center housing classrooms and laboratories and computer. The college will have its own wast water treatment plant treating waste water from th college and surrounding community. This plant wi be used in the training courses. (Makela-Texas)
W70-08914

PHOSPHORUS REMOVAL FROM EFFLUENT IN ALUMINA COLUMNS,
Battelle-Northwest, Richland, Wash.; and Rober A. Taft Water Research Center, Cincinnati, Ohio.
Lloyd L. Ames, Jr., and Robert B. Dean.
Journal, Water Pollution Control Federation, Vo 42, No 5, Part II, p R161-R172, May 1970. 6 fig, tab, 20 ref.

Descriptors: *Phosphorus, *Columns, *Costs *Tertiary treatment, Effluents, Efficiencies, Ad sorption, Waste water treatment, Sewage treat ment.
Identifiers: *Alumina, Loading, Regeneration, Elu tion.

An alumina column treating a synthetic secondar waste water effluent was studied. Small 1.1-cm diameter by 8-cm-high columns were used for th study. The alumina adsorption phenomena ha been considered to be essentially a highly selectiv ion exchange process with phosphorus also in volved in a secondary adsorption reaction. At 10% breakthrough the throughputs for 10.3, 7.0 and 3. mg P/l in the standard influent were 900, 1400 an 1900 column volumes respectively. The competi tion or effects of other anions on phosphoru removal was of interest because large concentra tions of other anions could significantly lower th phosphorus capacity of the alumina. The sulphat ion was chosen to demonstrate the interfering ef fects on phosphorus capacity. The concentration o magnesium and calcium also showed marked ef fects on alumina column phosphorus capacity. Ad sorption on the alumina occurs partly as a calciu or magnesium phosphorus complex rather than simple phosphorus anion. Elution of phosphoru was accomplished with 8 column volumes of molar sodium hydroxide followed by 20 columns o wash water. Estimated treatment cost including fi tration for a 10 MGD plant is between 5 and cents/1000 gallons for secondary effluent contain ing 10 to 12 mg P/l. (Hancuff-Texas)
W70-08915

TECHNIQUES FOR ESTIMATING CONSTRUC TION COSTS OF WASTE TREATMEN PLANTS,
Oklahoma Univ., Norman.
Kanti L. Shah, and George W. Reid.
Journal of Water Pollution Control Federation, Vo 42, No 5, Part I, p 776-793, May 1970. 1 fig, 9 tab 18 ref.

Descriptors: *Construction, *Costs, *Waste wate treatment, *Sewage treatment, *Statistics, *Mathe matical models, *Regression analysis, Industria waste, Sampling, Design, Stabilization, Ponds Trickling filter, Activated sludge.
Identifiers: Variables, Primary treatment.

Regression equations based on statistica techniques have been developed for estimating th unit construction costs of municipal waste treat ment plants, both in terms of design flow and popu lation equivalency. Regional differences wer taken into account in analyzing the data and a reasonable combinations of variables which wer thought to affect cost were considered. Tw

methods have been used to develop equations; (1) by analyzing separately the data of each type of plant, and (2) by combining the data and using dummy variables for the type of treatment plant. 809 letters with questionnaire forms were mailed including 49 letters to state health directors; 563 were completed. Data on 102 primary treatment plants were obtained. The relationships between the variables: cost per million gallons and flow in mgd were derived. For stabilization ponds only 12 of 157 plants reported current performance of treatment. Sample size for the standard rate trickling filter was 67 and an equation is derived for estimating unit construction cost in terms of dollars per mgd. Data on 120 high-rate trickling filter plants were obtained. Activated sludge treatment plants had a sample size of 115. The data on standard rate trickling filter, high-rate trickling filter, and activated sludge plants were combined and regression analysis was made with a sample size of 304. Since the logarithmic transformation of the variables gave the best fit, dummy variables were used in this form of linear equation. (Hancuff-Texas)
W70-08916

IMPROVED SETTLING TANK EFFICIENCY BY UPWARD FLOW CLARIFICATION,
British Wedge Wire Co. Ltd., Warrington (England).
V. R. Sparham.
Journal of Water Pollution Control Federation, Vol 42, No 5, p 801-811, May 1970. 3 fig, 2 tab, 10 ref.

Descriptors: *Settling basin, *Efficiencies, *Performance, *Sewage treatment, Beds, Trickling filter, Waste water treatment, Effluent.
Identifiers: *Upflow clarifier, Suspended solids.

Settleability of suspended solids from biological treatment of waste water varies widely. Polishing processes should not be relied on to substitute for poor settlement tank performance, which should be improved to insure an acceptable effluent for polishing process. For best results settlement tanks fitted with upflow clarifier elements should have a high surface volume ratio. Use of upflow pebble bed clarifiers in many smaller existing horizontal flows final settlement tanks improves settled effluent quality by 50% at maximum flows of 1 cu m/sq m/hr. The use of a single layer of wire mesh nearly eliminates pebble bed backwashing operations and costs while improving settlement tank performance by 50% at fully treated flow rates of up to 1 cu m/sq m/hr. Wedge wire mesh used in conjunction with suitable plastic matrices can reduce the suspended solids in settled effluent by 90% at 1 cu m/sq m/hr fully treated flow, and by 70% at 3 cu/m/sq m/hr for limited periods. A typical bed is described as 6 inches of gravel of 0.250-0.375 inches in diameter suspended 12 inches below the top water level of a final sediment tank. These clarifying elements may be adopted for stabilizing hydroxide floc blankets or activated sludge blankets in conventional potable water and waste water treatment. (Hancuff-Texas)
W70-08917

SIMPLIFIED GRAPHICAL EVALUATION OF BOD CURVE CONSTANTS,
Jadavpur Univ., Calcutta (India).
Dipak Bagchi, and Nilay Chaudhuri.
Journal of Water Pollution Control Federation, Vol 42, No 5, Part II, p R136-R139, May 1970. 6 fig, 3 tab, 2 ref.

Descriptors: *Mathematical model, *Computers, *Computer program, Laboratory tests, Analyses, Evaluation, *Biochemical oxygen demand.
Identifiers: *Graphical methods.

The method suggested by Fujimoto (Journal Water Pollution Control Federation, Vol 36:69, 1964) for the evaluation of first stage BOD curve constants is further simplified. The reorganized BOD equation shows a linear relationship between y sub t (BOD exerted in time 't') and y sub t+h-y sub t where y sub t+h is the BOD exerted in time t+h and can be used to evaluate the parameters L sub o the ultimate first-stage BOD and k the rate constant. The value of L is obtained directly from the graph as the intercept of the line on the absicca. The graphical technique can be used for evaluation even when BOD data are collected at irregular intervals of time. Evaluation of L sub o and k utilizing a digital computer becomes handy when a great bulk of data is to be processed. (Hancuff-Texas)
W70-08918

EVALUATION OF A COMPLETE MIXING ACTIVATED SLUDGE PLANT,
Kansas Univ., Lawrence.
Ross E. McKinney, Henry H. Benjes, Jr., and James R. Wright.
Journal of Water Pollution Control Federation, Vol 42, No 5, Part I, p 737-752, May 1970. 10 fig, 1 tab, 19 ref.

Descriptors: *Activated sludge, *Data collections, *Performance, *Mathematical model, Design, Facilities, Operation, Biochemical oxygen demand, Biological treatment, Evaluation, Waste water treatment, Nebraska.
Identifiers: *Complete mixing, Suspended solids, Grand Island (Nebraska).

Although complete mixing activated sludge waste water treatment plants have been in operation for a number of years there has been a reluctance to use this modification, mainly because of a lack of understanding of the fundamental concepts of biological waste water treatment, and in part due to the lack of sufficient operational data to give engineers confidence in the results which could be expected. Results of a 2.5 year study to obtain operational data from the Grand Island Waste Water Treatment plant in Nebraska is presented. In 1969 the water water flow of 5 MGD was 86% of the expected 1995 flows and the BOD was 78%. The aeration tank has a 3.8 hour detention time, BOD5 loading of 116 lb/cu ft/day about 4000-5000 mg/l mixed liquor suspended solids and 560 cu ft of air/lb of BOD5 load. The final effluent had an average of 7 mg/l BOD5, 98% reduction, in 1969 with an average of 3 mg/l BOD5, 99% reduction, for a 2.5 month period in April, May and June of 1969. The aeration system operated satisfactorily with air flow rates as low as 400 cu ft/lb BOD5 with an oxygen transfer of 0.47 lb O2/lb BOD5. The low oxygen transfer rate resulted in greater production in activated sludge than in conventional activated sludge systems. Excessively long storage in primary and secondary sedimentation tanks created definite operation problems with the transfer of much of the organic load from the primary system to the aeration system. (Hancuff-Texas)
W70-08919

MODEL OF NATURAL DRAFT COOLING TOWER PERFORMANCE,
Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest Water Lab
Lawrence D. Winiarski, and Bruce A. Tichenor.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA4, Paper 7461, p 927-943, August 1970. 11 fig, 2 tab, 7 ref, append.

Descriptors: *Cooling towers, *Thermal powerplants, *Mathematical models, *Computer programs, Evaporation, Heat transfer, Mass transfer, Water temperature, Thermal pollution, Water pollution control.
Identifiers: Natural draft cooling towers.

A method is developed for analyzing the performance of counterflow and crossflow natural draft cooling towers that does not assume saturated air at the top of the packing. Types of cooling towers and the principles of operation are considered. Simplified differential equations for the heat and mass transfer relations and the methods of integrating them for both counterflow and crossflow towers are given. A large number of integration steps is shown to be unnecessary. Equations for estimating the pressure losses in the tower are also given. Simplified flow charts using these integration schemes show how the computer program is used to evaluate tower performance. The computed performance of towers of various heights operating in moist and in dry conditions is shown. The effect of inlet water temperature is shown to be significant. Finally, the computed performance of a given tower with fixed inlet water temperature is shown as a function of relative humidity and dry bulb air temperature. (Knapp-USGS)
W70-08945

BULKING OF DAIRY WASTE ACTIVATED SLUDGE,
Agricultural Univ., Wageningen (Netherlands).
A. D. Adamse.
Water Research, Vol 2, p 715-722, 1968. 3 fig, 3 tab, 12 ref.

Descriptors: *Activated sludge, *Bacteria, *Dairy industry, Industrial wastes, Nutrient requirements, Oxygen requirements.
Identifiers: *Arthrobacter, *Bulking, *Sphaerotilus, Carbon-nitrogen ratio, Oxygen tension.

The phenomenon of bulking of a dairy waste activated sludge was studied in relation to known and estimated data concerning two types of microorganisms involved in the mechanism of bulking, vig. Sphaerotilus and Arthrobacter-like bacteria. Reduced oxygen supply, resulting from the high dissimilation rate of the carbohydrate fraction of the dairy waste, together with the ability to accumulate storage compounds and the discrepancy between the potential and actual C/N ratios of this waste, were considered to be the mainfactors in stimulating growth of Sphaerotilus, and thus to be responsible for bulking. Alteration of the nutritional conditions caused an improvement of the growth of Arthrobacter-like bacteria and this led to a pronounced relative suppression of Sphaerotilus, as a result of which the settling properties of the sludge were restored. (Aguirre-Texas)
W70-08954

ALL PARTIES CAN BENEFIT FROM JOINT MUNICIPAL-INDUSTRY TREATMENT,
Procter and Gamble Co., Cincinnati, Ohio. Corporate Environmental Control.
J. Floyd Byrd.
Water and Sewage Works, Vol 116, No 11, p IW14-IW21, November 1969. 2 fig.

Descriptors: *Wastes, *Water quality, *Economics, Biochemical oxygen demand, Efficiency Pollution abatement.
Identifiers: *Joint municipal-industry treatment, *Ordinance, Sewer tax, Flammable waste.

The technical aspects of joint treatment of wastes from many industries, commercial enterprises and house holds are discussed. In addition to the savings by a joint treatment operation, there are also many advantages: (1) Waste treatment is merely a sideline to industry's main effort of manufacturing and marketing a product, whereas combined treatment does the job effectively as they are done by the specialists. (2) Land availability is an important factor favoring combined treatment. (3) Domestic sewage contributes nutrients and dilution to industrial wastes, making them more amenable to degradation. The paper then refers to the suggested municipal sewer ordinance outlined in the Water Pollution Control Federation Manual of Practice No 3 entitled 'Regulation of Sewer Use.' The objectives of the municipal sewer ordinance are described and the requirements to achieve those objectives are discussed. The paper recommends that the chief engineer of the sewage treatment plant should be given enough discretionary powers to take care of unusual wastes. Certain wastes should not be banned automatically, just limit their quantities so as not to affect biological treatment adversely. The spirit of cooperation and mutual trust between municipality and industry must exist. (Shankar-Texas)
W70-08955

BACTERIA AND LAGOONS,
Department of Interior, Atlanta, Ga.
J. R. Franzmathis.
Water and Sewage Works, Vol 117, No 3, p 90-92, March 1970. 3 fig, 2 tab, 13 ref.

Descriptors: *Waste water treatment, *Stabilization, *Ponds, *Bacteria, *Coliforms, *Performance, *Lagoons, Effluents, Summer, Winter, Southeast U.S.
Identifiers: Fecal, Loading rates.

Waste stabilization ponds in the Southeast were sampled for effluent bacterial densities. It was found that single-cell ponds effluents did not meet the criterion set forth in the Report of The Committee on Water Quality Criteria which recommended an average not to exceed 2,000 fecal coliform per 100 ml. Three ponds of 2, 2.6 and 6 acreas, loaded at an estimated 16, 18 and 41 lb/acre/day, respectively were sampled and 593 analyses were performed during January and February 1968. The pond loaded at 41 lb/acre/day was sampled again in July and August 1968, and 184 analyses were performed. Average effluent fecal coliform density during the winter for all ponds was reported to be 56,000/100 ml. Results for the pond loaded at 41 lb/acre/day were 87,000 and 1,366,000/100 ml for winter and summer respectively. Limited sampling on larger ponds found an average fecal coliform density of 71,000/100 ml from an 8 acre pond loaded at an estimated 31 lb/acre/day, and 278,000/100 ml from two 36 acre ponds loaded at an estimated 26 lb/acre/day. It was recommended that controlled retention rather than uncontrolled average detention time must be the goal of design, if disinfection is not utilized. (Galwardi-Texas)
W70-08957

THE BIOLOGICAL TREATMENT OF CARBONIZATION EFFLUENTS--II. STUDIES OF THE INFLUENCE OF LIQUOR COMPOSITION,
British Coke Research Association, Chesterfield (England).
A. G. Ashmore, J. R. Catchpole, and R. L. Cooper.
Water Research, Vol 2, p 555-562, 1968. 4 fig, 3 tab, 1 ref.

Descriptors: *Biological treatment, *Industrial wastes, Activated sludge, Aeration, Investigations, Carbon, Coals.
Identifiers: *Carbonization effluents, *Liquor composition.

Studies of the influence of composition on the treatability of carbonization liquors have been made by determining their minimum period of aeration, in single-stage completely-mixed activated sludge systems. Using solutions of ammonium thiocyanate as the basic substrate, precise information has been obtained of the complex relationship between influent strength and rate of treatment. For ammonium thiocyanate alone, a stepwise relationship was observed between concentration and minimum period of aeration. The effect of the addition of 1000 mg/l of phenol was to modify this relationship to give a constant minimum of 30 hours for the range 300-1000 mg/l of CNS, reducing rapidly at lower CNS concentrations, thus illustrating the complex effect of dilution as found in liquor treatment. The inhibition due to the intractable permanganate value residue, present in biologically treated effluents, was conveniently simulated by addition of small amounts of oxidized catechol to the influent. The effect of these additions has been studied with synthetic solutions and with limed spent liquor, over a wide range of concentrations, and could be determined with a high degree of reproducibility. The results illustrate the profound influence of this type of inhibitor upon the economics of liquor treatment (Aguirre-Texas)
W70-08958

A BIOLOGICAL AND CHEMICAL STUDY OF SEVERAL ANEROBIC DIGESTERS,
National Inst for Water Research, Pretoria (South Africa)
J. P. Kotze, P. G. Thiel, D. F. Toerien, W. H. J. Hattingh, and M. L. Siebert.
Water Research, Vol 2, No 3, p 195-213, March 1968. 1 fig, 12 tab, 21 ref.

Descriptors: *Anaerobic digestion, *Biological properties, *Biological treatment, *Chemical properties, Analysis, Carbohydrate, Chemical analysis, Enzymes, Sewage treatment.

Biological and chemical analyses were carried out on several digesters operated on laboratory, pilot and full-scale. These digesters received a variety of substrates which included raw sewage sludge; industrial effluents, and a synthetic substrate. Hexose monophosphate sluent enzymes could only be demonstrated in very active digesters receiving substrates high in carbohydrate material. The glycolytic pathway, glyoxylic acid and citric acid cycles were found in all the anaerobic digesters analyzed. Enzyme activity tests revealed different stages of adaptation of a raw sewage digester adapted to a synthetic substrate. Digesters receiving different substrates showed characteristic enzyme activity patterns, but chemical analysis such as pH, alkalinity and volatile fatty acid content did not demonstrate any obvious differences between these digesters. (Aguirre-Texas)
W70-08959

WATER CONSERVATION AND REUSE BY INDUSTRY,
Texas A and M Univ., College Station. Environmental Engineering Div.
Robert L. Irvine, Jr., and William B. Davis.
Water and Wastes Engineering, Vol 7, No 1, p 17-19, January 1970. 3 fig, 4 ref.

Descriptors: *Water reuse, *Industries, *Conservation, *Cost analysis, Industrial wastes, Biological treatment, Management, Cost comparisons, Waste water treatment.
Identifiers: *Segregation of wastes.

The concept of water conservation and reuse was presented in order to promote industrial implementation of inplant water management programs. Industry has avoided such programs; assuming that the quantity and quality of its water supply have been and will be constant in time and space. Waste treatment and its associated cost seems to be generally feared. Cost analyses were presented that point out the economic benefits of conservation and reuse. In addition, procedures were described that increase the efficiency of biological waste treatment facilities. The segregation of waste streams was stressed. Also, with the implementation of conservation and reuse programs, the cost of waste treatment becomes part of the production scheme. (Galwardi-Texas)
W70-08960

CASUAL OBSERVATIONS OF PROTOZOA IN TERTIARY SEWAGE TREATMENT,
Illinois State Water Survey, Peoria, Ill.
Ralph L. Evans, and Davis B. Beuscher.
Water and Sewage Works, Vol 117, No 2, p 35-41, February 1970. 6 fig, 2 tab, 18 ref.

Descriptors: *Activated sludge, *Biological communities, *Biota, *Efficiencies, *Ecology, *Protozoa, *Tertiary treatment, Biochemical oxygen demand, Dissolved oxygen, Regression analysis, Retention, Sewage lagoons, Turbulence, Waste water treatment.
Identifiers: *Biological examinations, Biological activity, Suspended solids.

Observations were made of predominant fauna (protozoa) in a tertiary sewage treatment (TSP) complex interposed between the treated effluent of an activated sludge plant and the receiving stream, the Illinois River. The tertiary unit was preceded by an activated sludge process. A brief review of the ecology of activated sludge is presented. Results of the test showed that the average reductions based on about 260 samples, were 23% and 41% for BOD5 and suspended solids respectively. The regression equations developed, defining the probable relationships of suspended solids to BOD5 suggest that BOD5 reduction is not solely a function of the sedimentation of suspended solids. Biological activity did not appear to be beneficial. Predominant protozoa observed in the pond system were flagellates, while cilates were dominant in the aeration units. The average concentration of protozoa was greater than 2000000 organisms per liter with ciliates either absent or in concentrations less than 500000 organisms per liter. Because of the apparent advantage of the ciliated protozoa and the non-beneficial nature of the flagellates it may seem desirable to create condtions within a TSP to stimulate their productivity. Also a slight increase in DO might be beneficial. (Shankar-Texas)
W70-08961

WASTE WATER FOR GOLF COURSE IRRIGATION,
California State Water Resources Control Board, Goleta.
David L. Sullivan.
Water and Sewage Works, Vol 117, No 5, p 153-159, May 1970. 7 fig, 1 tab.

Descriptors: *Effluents, *Soil properties, *Irrigation, *Grasses, Biological properties, Bioindicators, Chlorination, Oil, Alkalinity, Disinfection, Sludge digestion, Reuse

The use was demonstrated of sewage treatment plant effluent for grass irrigation in a new city golf course. A project was designed to point out the advantages and disadvantages of effluent irrigation, to select a suitable grass, and to determine the feasibility of this course of action. A 4-acre plot in Ventura was chosen to conduct the study. The grasses chosen for the study were old orchard, sea side bent, and Kentucky blue grass. Secondary clarifier effluent from the East Side Plant was used rather than final effluent, so that any bacteriological effects could be studied at a higher level of concentration. About 5 million gallons of digested sludge were spread throughout the area in which the test plots were located. Three plots were chosen for irrigation with domestic drinking water and three for irrigation with treated effluent. At the end of the experiment no harmful effects of effluent irrigation could be noticed in the grace. Oils and grease in the effluent soil had no effect upon growth, since the detergents present dissolved the oils and fats. The tendency of alkalinity, chloride ion concentration and other items to change was of major concern to the study. Kentucky blue grass is not suitable for golf courses since it is very sensitive to salt concentrations. (Shankar-Texas)
W70-08962

PRACTICAL METHODS FOR DETERMINING SEWAGE FLOW FOR ALL COMMUNITIES,
Metropolitan Corp. of Greater Winnipeg (Manitoba).
R. M. Girling.
Water and Sewage Works, Vol 116, No 7, p 250-258, July 1969. 7 fig, 4 tab, 7 ref.

Descriptors: *Instrumentation, *Industrial wastes, *Sampling, Design criteria, Corrosion, Manholes.
Identifiers: *Stilling well, *Radioactive isotopes, *Average flow, *Parshal flume, *Municipal sewage syste, Regulators, Plumb bob.

Measurement of sewage flow rate has become an important aspect in practical sanitary engineering. Starting from the basic concepts of flow measuring devices, the reasons for the measurement of sewage flow rate are enumerated. Various methods of measurement and the corresponding measuring devices are briefly explained, with particular reference to sewage measurement. The circumstances under which a particular type of measuring device is used are explained. The limitations, possible errors while using and the advantages of each type of measuring device are briefly presented. A method for measuring flow rate at sewage pumping stations is also given. Problems are worked out to illustrate the ap

plication of various devices. (Radhakrishnan-Texas)
W70-08963

PHOSPHORUS REMOVAL--PAST, PRESENT, AND FUTURE,
Maine Univ., Orono; and Illinois Univ., Urbana.
Millard W. Hall, and Richard S. Engelbrecht.
Water and Waste Engineering, Vol 6, No 8, p 50-53, August 1969.

Descriptors: *Nutrients, *Phosphorus, Activated sludge, Chemical precipitation, Coagulation, Ion exchange. Land use, Waste water treatment.
Identifiers: *Phosphorus removal, Chemical-biological processes, Chemical sorption, Electrochemical method.

An economical, predictable and highly efficient process for removing phosphorus from waste waters has not yet been developed. Because of the varied nature of the problem, it is unlikely that a single removal method can be developed for application to all cases. For this reasons, research and development should continue on a variety of processes for phosphorus removal. Methods now being used and developed are: (a) chemical precipitation and coagulation, (b) chemical-biological processes, (c) chemical sorption, (d) electrochemical method, (e) ion exchange, (f) land application, and (h) activated sludge. The addition of lime to secondary effluent, followed by mixing, flocculation and settling can reduce the phosphorus concentration by 99% or more. Sludge disposal is the main problem. The most economical design for a chemical-biological phosphorus removal process should employ chemical treatment prior to biological treatment. The process is considered capable of removing 90 to 95% of total phosphorus from domestic sewage containing 13 to 17 mg/l P and estimated chemical costs of $8 per MG. A comparison of alternate phosphorus removal methods shows that these can range from electrochemical treatment giving 81 to 85% removal for $4 to 8 per MG to algal ponds giving 80 to 90% removal at a cost of $1100 to 1300 per MG. (Aguirre-Texas)
W70-08964

REGENERATION OF OXIDATIVE ASSIMILATION CAPACITY BY INTRACELLULAR CONVERSION OF STORAGE PRODUCTS TO PROTEIN,
Oklahoma State Univ., Stillwater.
K. C. Goll, and A. F. Gaudy, Jr.
Applied Microbiology, Vol 16, No 9, p 1352-1357, September 1968. 4 fig, 7 ref. FWPCA Grant WP 00325.

Descriptors: *Activated sludge, *Microbiology, *Oxidation, *Proteins, Biochemistry, Carbohydrates, Enzymes, Nitrogen, Sludge, Waste water treatment.
Identifiers: *Intracellular conversion, *Storage products, Endogenous respiration, Oxidative assimilation capacity, Substrates.

Previous studies have shown that the capacity of a heterogeneous microbial population for oxidative assimilation of glucose can be renewed by periodically subjecting the sludge to endogenous respiration in the presence of an exogenous source of nitrogen. Further study of this system led to a modification of the activated sludge process for nitrogen-deficient wastes. It was not known whether renewal of oxidative assimilation capacity was possible for substrates which required the presence of inducible enzymes or for substrates which were not carbohydrates. Studies with lactose and acetate as carbon sources were designed. Both carbon sources were removed under conditions of oxidative assimilation, and the storage products were converted into protein when the sludge was subjected to a period of endogenous respiration in the presence of an exogenous supply of ammonium sulfate. The 'regenerated' sludge exhibited a renewed capacity for oxidative assimilation, indicating that requisite inducible enzymes were not diluted out in the endogenous phase to a degree sufficient to hamper renewed oxidative assimilation capacity. A noncarbohydrate carbon source can be successfully removed from the medium with this process. In the case of acetate, the oxidative assimilation capacity after 'regeneration' was not fully restored to the initial level. (Aguirre-Texas)
W70-08965

GROWTH OF MIXED CULTURES ON MIXED SUBSTRATES I. CONTINUOUS CULTURE,
Massachusetts Inst. of Tech., Cambridge.
S. K. Chian, and R. I. Mateles.
Applied Microbiology, Vol 16, No 9, p 1337-1342, September 1968. 6 fig, 1 tab, 16 ref. WASA Grant NsG-496.

Descriptors: *Cultures, *Growth rates, Biochemistry, Coliforms, Microbiology, Pseudomonas, Waste water treatment.
Identifiers: *Mixed cultures, *Mixed substrates.

Continuous culture on mixed glucose-lactose or glucose-butyrate media inoculated with river water led to a population composed of a pseudomonad and a coliform. The glucose was used preferentially to the other carbon source, and the utilization of the secondary carbon source was greatly reduced at high growth rates. Significant amounts of acetate were excreted even though the cultures were limited by the carbon source, rather than by oxygen or other nutrients. At high growth rates, the pseudomonad dominated the population, whereas at low and moderate growth rates the coliform was dominant. A syntrophic relationship was shown by the fact that the pseudomonad could not grow alone on the glucose-butyrate medium. (Aguirre-Texas)
W70-08966

WASTE WATER LOAD EVALUATED AT A MULTI-PRODUCT ORGANIC CHEMICAL PLANT,
Atlas Chemical Industries, Inc., Wilmington, Del.
A. J. Morrissey, and S. A. LaRocca.
Water and Sewage Works, Vol 117, No 5, p 173-178, May 1970. 10 fig, 2 tab, 1 ref.

Descriptors: *Evaluation, *Industrial wastes, *Organic compounds, *Organic loading, *Waste water treatment, Activated sludge, Organic wastes.
Identifiers: *Multi-products.

Atlas embarked on a program to characterize the waste waters discharged from its Atlas Point plant. The program involved sampling all waste waters that the plant generated. Data on oxygen utilization with time for each of these waste water outfalls were obtained. The effect of these discharges on the receiving waters of the Delaware River was investigated. Production data were screened to determine if a relation between process losses and VOD1 discharged could be established. The production equipment within the plant was sampled to provide a basis for segragating cooling waters from other waste waters. Combining all of the waste water outfalls sampled during the outfall sampling program results in a total average flow of about 13,000 gpm. The analyses performed on ten of the plant's waste water outfalls concluded with deoxygenation constants (to the base e) ranging from 0.18 to 0.36. Ratios of VOD1 to BOD5 ranged from 1.19 to 1.67 and averaged 1.45. For the various station averages, pH varied from a low of 6.2 to a high of 8.8; COD from 100 to 14,500 mg/l, BOD5 from 50 to 9000 mg/l and VOD1 from 65 to 12,900 mg/l. Flows averaged in the range from 10 to 9900 gpm. (Aguirre-Texas)
W70-08967

THE EFFECT OF PSYCHODA ALTERNATA (SAY.), (DIPTERA) AND LUMBRICILLUS RIVALIS (LEVINSEN) (ENCHYTRAEIDAE) ON THE EFFICIENCY OF SEWAGE TREATMENT IN PERCOLATING FILTERS,
Water Pollution Research Lab., Stevenage (England).
N. V. Williams, and H. M. Taylor.
Water Research, Vol 2, No 2, p 139-150, February 1968. 19 fig, 3 tab, 18 ref.

Descriptors: *Effects, *Efficiencies, *Sewage treatment, *Trickling filters, Worms, Waste water treatment.
Identifiers: *Psychoda alternata, *Lumbricillus rivalis.

It is said that the macrofauna in trickling filters influence the efficiency of treatment by controlling the growth of film, thus reducing the tendency toward blocking. The present study was designed to establish the effect of the two types of macroinvertebrates, psychodid flies and enchytraeid worms, separately and in mixed populations, on the efficiency of trickling filters. Four groups of triplicate perspex filters were supplied with artificial sewage at a constant temperature of 15 deg C, one group being inoculated with psychodid larvae, one with enchytraeid worms, one with mixtures of flies and worms, and one being kept free as a control. The film in the control group grew rapidly and blocked the filter, causing ponding and producing anaerobic conditions. The efficiency of treatment, measured in terms of BOD and organic carbon removal, decreased from 90% to 40%, some of the carbon being removed by anaerobic decomposition. The two groups containing fly populations showed increased efficiencies (>90%) within 2 months of inoculation, with the larvae successfully controlling the film accumulations. The filter group containing worms achieved similar high treatment efficiencies, but not until 5 months after inoculation, the worm populations increasing more slowly because of longer development periods. (Aguirre-Texas)
W70-08968

FEDERAL GRANTS AVAILABLE FOR INDUSTRIAL POLLUTION CONTROL,
Federal Water Pollution Control Administration, Washington, D.C.
William J. Lacy, and Allen Cywin.
Water and Sewage Works, Vol 116, No 5, p 12-15, May 1969. 1 fig, 1 tab, 3 ref.

Descriptors: *Industrial wastes, *Waste water treatment, *Treatment facilities, *Research and development, *Costs, Pollution abatement.
Identifiers: *Federal programs, *Federal grants, Joint industrial-municipal treatment.

Federal water pollution control programs are described with emphasis being placed on the industrial research and development (R and D) program. The program's general objective is to provide each basic industry the demonstrated, developed, and evaluated technology for the abatement or prevention of water pollution. The R and D program involving research, development and demonstration consists of three components: an in-house effort, a grants program and a contract program. More than 80% of the monies available to the FWPCA for R and D are used in the form of grant and contract payments. Industry can now apply for grants which pay as much as 70% of a project cost up to $1 million. The sequence of review for grant proposals is outlined. Several industrial grants are described. Projected schedules of investments in waste treatment facilities by industry and generalized cost ranges for treatment processes for some industries are summarized. It is estimated that industrial waste treatment costs over the next five years will be $2.6 to 4.6 billion. Joint industrial-municipal treatment is another R and D program area. Grants may be awarded for as much as 75% of the estimated reasonable cost of the project while contracts may be awarded for up to 100% of the project cost. (Galwardi-Texas)
W70-08969

WASTE WATER TREATMENT FOR COMPLETE NUTRIENT REMOVAL,
Notre Dame Univ., Ind. Dept. of Civil Engineering.
Wayne F. Echelberger, and Mark W. Tenney.
Water and Sewage Works, Vol 116, No 10, p 396-402, October 1969. 6 fig, 8 ref.

Descriptors: *Waste water treatment, *Nutrients, *Pilot plants, *Nitrogen, *Phosphorus, Treatment facilities, Biological treatment, Activated sludge, Nitrification, Denitrification, Indiana.
Identifiers: Chemical treatment, Extended aeration, South Bend.

An integrated treatment scheme consisting of a combination of chemical and biological treatment methods designed for the concurrent removal of both organic and euthrophying pollutants was investigated. A flow diagram of the pilot plant treatment process was outlined. Soluble organic carbon was removed by a high rate activated sludge system followed by an extended aeration system for partial aerobic destruction of biological solids and conversion of all forms of nitrogen to nitrate. Metal ion addition, aluminum or iron was provided in the extended aeration system for phosphate precipitation and for enhancement of the flocculation and settleability of the micro-organisms. Removal of inorganic nitrogen was accomplished by passing the nitrified liquid through an anaerobic contact system that reduced the nitrate nitrogen to nitrogen gas. Methanol was used as a supplemental organic carbon source in the anaerobic contact reactor. Bried aeration of the denitrification reactor effluent released additional nitrogen gas and conditioned the microbial solids for improved settleability prior to ultimate discharge of the treated waste water. A vacuum filtration-incineration process appeared to be the most desirable for the treatment of excess sludge. (Galwardi-Texas)
W70-08970

U-TUBE OXYGENATION OPERATING CHARACTERISTICS,
New Mexico State Univ., Las Cruces.
R. E. Speece, and Jack L. Adams.
Proceedings Industrial Waste Conference, 23, p 195-212, May 1968. 17 fig, 1 tab, 1 ref.

Descriptors: *Aeration, *Oxygenation, *Performance, *Waste water treatment, Headloss, Dissolved oxygen, Water management (Applied), Water treatment.
Identifiers: *Oxygen transfer, *U-tube oxygenation, *Operating characteristics, Parameters.

Oxygen transfer to water is a vital process in water quality management. U-tube oxygenation appears to be the most economical oxygenation system available for saturating water, which is desirable in water and waste water treatment processes, river-oxygenation, reservoir oxygenation and fish hatchery operations. As much as 3000 lbs of oxygen per day per 1000 cu ft can be dissolved in a U-tube aerator. The system can be used in natural situations without outside power requirements for stream re-oxygenation where a small hydraulic head of 3 to 4 ft is available. The inherent advantages of U-tube oxygenation are: (1) a high oxygen transfer coefficient resulting from high rates of surface renewal, (2) a long contact time between the bubbles and the water, and (3) an increased dissolved oxygen deficit caused by increasing the saturation concentration due to the hydrostatic head pressurizing the bubbles. The experimental system used consisted of a 40 ft U-tube aerator supplied with compressed air. The variables considered consisted of air-water ratio, water velocity, diffused depth, U-tube depth, water flow rate, air flow rate, diffuser type and oxygen content of the bubbles. Depths of 40 ft or more and nominal water velocities greater than six fps are favored for the design of a U-tube system. In cases where air is injected, minimum diffuser depths are best. (Galwardi-Texas)
W70-08971

THE RELATIONSHIP OF FLOW CHARACTERISTICS TO CHANGES IN SLUDGE CONSISTENCY,
John Hopkins Univ., Baltimore, Md.; and National Council of the Paper Industry for Air and Stream Improvement, Inc.
William L. Carpenter, and Jack Grossman.
Proceedings Industrial Waste Conference, 23, p 680-690, May 1968. 3 fig, 9 tab, 14 ref.

Descriptors: *Industrial wastes, *Sludge, *Flow measurement, *Flow characteristics, *Flow resistance, Velocity, Headloss, Reynolds number, Pulp wastes, Pulp and paper industry, Waste water treatment.
Identifiers: *Paper mill, Solids content, Fibre content.

The effect of solids concentration, velocity and fibre content of representive paper mill sludges were examined to determine their relationship to pipeline head losses. Nine paper mill sludges representing the major types resulting from mill processes and degree of treatment were selected. The equation of Behn was used to describe the non-Newtonian flow anticipated for the sludges. The fibre content of paper mill sludges was shown to be the single most important factor controlling head loss. At high velocities, sludges containing low fibre or solids content had greater head losses than sludges of high fibre or solids content. A relative change in velocity above three fps produces less relative change in head loss with sludges of high solids or fibre than occurs with sludges of low solids or fibre content. Fibre content ranged from 5 to 61%, solids content ranged from 0.5 to 4.2% and velocities ranged from 0.5 to 10 fps during the experiments. Biological sludges produce greater head losses than primary sludge of corresponding solids and fibre content. (Galwardi-Texas)
W70-08972

PURIFICATION OF STARCH INDUSTRY WASTE WATER,
Carl F. Seyfried.
Proceedings Industrial Waste Conference, 23, p 1103-1119, May 1968. 12 fig, 2 tab, 12 ref.

Descriptors: *Industrail wastes, *Treatment facilities, *Biochemical oxygen demand, *Activated sludge, Performance, Efficiencies, Rice, Potatoes, Wheat, Waste water treatment.
Identifiers: *Starch industry, *Germany, *Characteristics, *Flow diagram, Iron sulphate, Extended aeration.

Treatment systems utilized in Germany for the treatment of starch industrial waste water are described. Water consumption of the starch industry in producing 250,000 tons/year of starch is estimated at 2.64 billion gal/year. Pollution by the starch industry equals more than one million population equivalents per working day. Flow diagrams and waste characteristics of plants producing maize, potatoes, wheat and rice starches are summarized. Spray irrigation of waste water of up to 300 mm/year with a concentration of 220 lb BOD5/acre/day is carried out in a large number of smaller factories. Pilot plant studies showed that an activated sludge system could be used in the treatment of starch wastes but that the addition of iron sulphate was required to lower the sludge volume index. At present a full scale activated sludge system is treating 0.63 MGD of a combined maize and rice starch waste with a BOD5 removal efficiency of 97% at a loading of 2.5 kg/cu m/day. Digester supernatant liquor is utilized instead of iron sulphate as a loading agent for the sludge. For the treatment of potatoe and wheat starch waste waters the double-stage activated sludge process yields better results than the single stage and complete treatment can be achieved only at a very low sludge loading and extended aeration. (Galwardi-Texas)
W70-08973

WHAT THE WASTE WATER PLANT ENGINEER SHOULD KNOW ABOUT CENTRIFUGES,
Pennwalt Corp., Warminster, Pa.
Joseph R. Townsend.
Water and Wastes Engineering, Vol 6, No 11, p 42-44, November 1969. 4 fig, 2 tab.

Descriptors: *Waste water treatment, *Centrifugation, *Performance, Capital costs, Activated sludge.
Identifiers: *Tubular bowl, *Disc, *Decanter, *Solid-bowl basket, Parameters.

The use of centrifuges in waste water treatment has increased significantly in recent years. The principles of centrifugation and the capabilities of four types of centrifuges, tubular bowl, disc, decanter, and solid-bowl basket were discussed. The following parameters were presented for each type of centrifuge, bowl diameter, flow rate, solids infeed, discharged solids, temperature range, pressure range, speed, gravity, motor power required and size of particles removed. Relative performances of the disc, decanter and solid-bowl basket centrifuges on a municipal activated sewage sludge were presented. On the assumption that an 85% recovery of particles in an activated sludge was satisfactory, the capital costs were calculated. The disc centrifuge was found to have the lowest cost per unit capacity. For maximum sludge concentration, the basket type was found to be superior while the decanter centrifuge was found to be potentially economical only when used with chemical treatment. (Galwardi-Texas)
W70-08974

METHODS OF CHARGING FOR THE RECEPTION, TREATMENT AND DISPOSAL OF TOXIC WASTES,
Upper Tame Main Drainage Authority, Birmingham (England).
N. Harkness
Water Pollution Control, Vol 69, No 3, p 314-320, 1970. 1 fig, 2 tab, 27 ref.

Descriptors: *Control, *Disposal, *Biological treatment, *Toxicity, *Sewage treatment, Biochemical oxygen demand, Biodegradation, Oxygen demand, Pilot plants, Waste water treatment.
Identifiers: Treatability factor, Oxygen uptake.

The methods for the determination of charges for the acceptance, treatment and disposal of toxic wastes are discussed. For the reception of wastes into sewers the methods are likely to be similar to those used for other wastes. The purpose is to determine the effect of toxic wastes on the treatment of sewage and to assesss the costs of accomodating toxic wastes at the works. In the experimental examination of treatment of toxic wastes the main consideration must be the quality of the effluent produced. Small scale experimental treatment plants have provided a basis for determining the effect of toxic wastes on the treatment of sewage taking into account adaptation to the waste, reduced purification of sewage due to toxic effects, and the additional treatment of biodegradable constituents. In situations where pilot or laboratory treatment unit experiments are not warranted, then consideration of oxygen uptake by sewage with and without toxic wastes, and if appropriate, the organic content of the toxic waste relative to sewage, may provide a basis for determining a charge for acceptance of toxic wastes. (Sharkar-Texas)
W70-08975

TRISODIUM NITRILOTRIACETATE AND ALGAE,
Ontario Water Resources Commission, Toronto.
A. E. Christie.
Water and Sewage Works, Vol 117, No 2, p 58-59, February 1970.

Descriptors: *Algae, *Activated sludge, *Toxicity, *Laboratory tests, Detergents, Waste water treatment.

Identifiers: *Trisodium nitrilotriacetate, *Chlorella pyrenoidosa, Source of nitrogen, NTA.

The relationships between trisodium nitrilotriacetate, a potential detergent builder, and the algae Chlorella pyrenoidosa were investigated, in an acclimated activated sludge system, with respect to toxicity and as a source of nitrogen both before and after treatment of the material. It was reported that trisodium nitrilotriacetate is non-toxic to fish at concentrations up to 100 mg/l, to mammals fed up to several thousand milligrams per kilogram body weight, and non-irritating to human skin. Results indicated that NTANa3 at concentrations up to 275 mg/l was not toxic to the test organism Chlorella pyrenoidosa and could act as a source of nitrogen for algal growth, although, not to the same extent as equivalent quantities of nitrogen, fed as nitrate, under the same test conditions. Treatment of 275 mg/l NTANa3 by an acclimatized activated sludge system did not reduce the algal growth potential of the chemical. The feasibility of using biodegradable organic materials which contain neither nitrogen or phosphorus as detergent builders should be thoroughly considered. (Galwardi-Texas)
W70-08976

HEAT TREATMENT OF SEWAGE SLUDGES,
University Coll. of South Wales and Monmouthshire, Cardiff. Dept. of Mechanical Engineering.
R. B. Brooks.
Water Pollution Control, Vol 69, p 221-231, 1970. 11 fig, 6 tab, 8 ref.

Descriptors: *Heat treatment, *Sewage sludge, *Chemical oxygen demand, Dissolved solid, Biological treatment, Additives, Solvent extraction, Evaporation, Nitrogen, Ammonia, Sewage treatment, Waste water treatment.
Identifiers: *Liquor, *Full scale plant, *Laboratory treatment, Calorific value.

The object of the work was to obtain data which could be used to predict both the degree of sludge conditioning and the type of liquor produced from a variety of sludges in a full-scale plant. A comparison is made between laboratory and full-scale treatment. The laboratory results were similar in all respects to those of full-scale operation. Comparison of activated sludges from different localities conditioned to the same extent gave similar liquors when heat treated. The concentrations of individual components in a heat treatment liquor increased in proportion to the feed solids concentration. The COD was related to the dissolved solids (DS) by the relationship COD=1.234 + 2026 (mg/l). The organic N content of heat treated liquor was proportional to the DS, there being one relationship for activated sludge and others for humus, primary, activated and digested sludges. The production of ammonia N as a percentage of the total soluble nitrogen, increases with reaction temperature and holding time. Reference is made to the use of activated carbon, coal, and additives. The calorific value of heat treated sludge was slightly higher than that of untreated sludge. Calculations have shown that all the potential heat is recovered from a sludge. A 3% sludge feed could produce a thermally self sustaining process. (Shankar-Texas)
W70-08978

METABOLISM OF SUSPENDED MATTER IN ACTIVATED SLUDGE TREATMENT,
Nagoya City Water Works and Sewerage Bureau (Japan).
Shunzo Takahashi, Toshihiko Fujita, Michio Kato, and Takashi Saiki.
Advances in Water Pollution Research, Proceedings, Fourth International Conference on Water Pollution Research, Sec II, Paper 3, Prague, Apr 21-25, 1969, London, Pergamon Press, 1969, p 341-360, September 1968. 12 p, 8 fig, 4 tab, 11 ref.

Descriptors: *Activated sludge, *Biological treatment, *Metabolism, *Suspended load, Adsorption, Bacteria, Colloids, Effects, Waste water treatment, Sewage treatment.
Identifiers: *Suspended solids, Mixed liquor suspended solids, Soluble matter.

The purification mechanism of sewage by activated sludge is classified into: (a) removal and metabolism of suspended and colloidal matters; (b) adsorption, absorption, and metabolism of soluble matter. Although much work has been done on the latter, very little is known about the metabolism of the former. The proportion of suspended and colloidal organic matter in the toal organic matter in sewage is high; 60% of the total volatile solids and 76% of the total COD of raw sewage is contributed by this fraction. The results described show that under the condition of 4000 mg/l MLSS, and feeding every 4 hours, proteinaceous suspended matter (4 microns - 1 micron) was metabolized by 42% during 20 hours. Proteinaceous suspended matter (60 microns - 4 microns) was metabolized by 30% during 20 hours. Proteinaceous suspended matter (2mm- 60 microns) was hardly metabolized during 20 hours. The adsorption activity of activated sludge was decreased by adsorption of colloids and was recovered by metabolizing these colloids and bacterial growth. Suspended matter did not inhibit the adsorption or absorption of soluble matter by activated sludge. Soluble matter was not released into the liquid phase by metabolizing suspended matter. Suspended matter accelerated the metabolism of soluble matter by activated sludge. The effect of soluble matter on the metabolism of suspended matter depended on the soluble substrate and the condition of the activated sludge. Both bacteria and protozoa metabolize suspended matter. (Aguirre-Texas)
W70-08979

NUTRIENT REMOVAL FROM SEWAGE EFFLUENTS BY ALGAL ACTIVITY,
National Inst. for Water Research, Pretoria (South Africa).
J. Hemens, and G. J. Stander.
Advances in Water Pollution Research, Proceedings, Fourth International Conference on Water Pollution Research, Prague, Apr 21-25, 1969, London, Pergamon Press, 1969, p 701-716.

Descriptors: *Algae, *Hydrogen ion concentration, *Nutrients, *Tertiary treatment, Biological treatment, Nitrogen, Phosphorus, Sewage effluents.
Identifiers: *Algal activity, *Nutrient removal.

Results obtained in removing nitrogen and phosphorus from sewage effluent based on a modification of the methods reported by other workers is described. The results suggest that instead of attempting to remove nutrients from sewage effluent by assimilation into new algal cells it may be more practical, under suitable climatic conditions, to exploit the effects of pH increase due to algal photosynthesis and to avoid the problems of light utilization by dense algal cultures. The basic requirements for this system would be a level of photosynthesis sufficient to produce the pH increase required to precipitate phosphate and to promote loss of ammonia to the atmosphere. The decrease in ammonia and phosphate removal observed during the night might be overcome by the provision of sufficient fluorescent light above the experimental discs to lessen the pH decrease. Alternatively, pH control by the addition of alkaki might be possible, particularly since it was observed that the reduction in alkalinity during daylight reduced the amount of lime required to reach a pH of 10.3 by as much as 75% when compared to that necessary to achieve the same increase in the untreated effluent. (Aguirre-Texas)
W70-08980

LINEAR SUBSTRATE REMOVAL IN THE ACTIVATED SLUDGE PROCESS,
Texas Univ., Austin.
Lial F. Tischler, and W. Wesley Eckenfelder, Jr.
Advances in Water Pollution Research, Proceedings, Fourth International Conference on Water Pollution Research, Prague, April 21-25, 1969, London, Pergamon Press, 1969, p 361-384.

Descriptors: *Activated sludge, *Kinetics, Biological treatment, Chemical oxygen demand, Cultures, Organic matter, Rates, Sewage treatment, Waste water treatment.
Identifiers: Linear substrate removal, Soluble substrate.

Removal of mixtures of various simple organic compounds was investigated using mixed biological cultures in an effort to predict the kinetics of the activated sludge process. The simple organic compounds glucose, phenol, and analine were all removed linearly (zero order) by an activated sludge acclimated to a mixture of the compounds. Variation of the initial concentration of each compound had no effect on the removal rate of the compound by a given sludge. The removal rates of the compounds in a unit containing a mixture of the three, were the same as the rates found when each compound was tested alone. This indicates that different types of organisms may be responsible for the removal of each simple substrate. The predominant type of microorganism present in the continuous activated sludge unit was determined by the organic loading level on the unit. A filamentous sludge, found at higher loadings, was capable of assimilating glucose and phenol at significantly greater rates per unit biological solids than the flocculant sludges found at low and intermediate organic loadings. The linear removal rate for each compound increased linearly with increasing biological solids concentration. Overall organic removal, as measured by COD or TOC from a mixture of three or five linearly-removed simple compounds by an activated sludge acclimated to these compounds is actually a summation of the removals of each of the simple compounds. The removal of these mixtures can approximate first order kinetics. (Aguirre-Texas)
W70-08981

THE SUCCESSION OF MICROBIAL PROCESSES IN THE ANAEROBIC DECOMPOSITION OF ORGANIC COMPOUNDS,
Hydraulic Research Inst., Prague (Czechoslovakia).
Jiri Hausler.
Advances in Water Pollution Research, Proceedings, Fourth International Conference on Water Pollution Research, Prague, April 21-25, 1969, London, Pergamon Press, 1969, p 407-426.

Descriptors: *Anaerobic digestion, *Metabolism, *Organic compounds, Acid bacteria, Anaerobic bacteria, Bacteria, Biological treatment, Fermentation, Methane bacteria, Waste water treatment, Sewage treatment.
Identifiers: *Microbial processes.

In the biological methane production, it was assumed that methane and carbon dioxide resulted from the fermentation of cellulose due to the activity of only one species of microorganism-Bacillus omelianskii. Later it was shown that the production of methane is the result of complicated microbial processes occurring in several stages. Insufficient attention seems to have been paid to the succession of these microbial processes of methane digestion. In industrial wastes with a high carbohydrate content (more than 2 g/l), butyric fermentation predominates during the first stage of methane digestion. Acetic and butyric acids are produced as well as CO_2 and CH_4 in the ratio of 1:1. In the second stage the main products are acetic, propionic and butyric acids. In this stage three successive characteristic processes can be observed: (a) The butyric acid is decomposed by beta-oxidation to acetic acid. (b) Acetic acid is decomposed mainly by Methanosarcina methani to CO_2 and CH_4. (c) The last step is the degradation of propionic acid to acetic acid. This process is due to the activity of Methanobacterium propionicum. The acetic acid is then further decomposed to CO_2

and CH4. A new method for anaerobic treatment of industrial wastes with high carbohydrate content is suggested. The method is based on the fact that the whole process follows a natural succession divided into several physiological stages, with each stage taking place in a separate digester thus preventing antagonism between the specific species of microorganisms. After the acid digestion, the effluent must be neutralized with lime. (Aguirre-Texas)
W70-08982

THE PATHWAYS OF PHOSPHORUS IN BIOLOGICAL TREATMENT PROCESSES,
California Univ., Berkeley.
David Jenkins, and Arnold B. Menar.
Advances in Water Pollution Research, Proceedings, Fourth International Conference on Water Pollution Research, Prague, April 21-25, 1969, London, Pergamon Press, 1969, p 677-700.

Descriptors: *Biological treatment, *Phosphorus, Metabolism, Nutrients, Phosphates, Waste water treatment, Sewage treatment, Detergents.
Identifiers: *Pathways, *Phosphorus removal, Mechanisms, Sources.

In a residential community the synthetic detergent contribution to raw sewage phosphorus is between 60-67%. In primary sedimentation phosphorus removal is between 5-15%. The primary sludge contains between 0.61 and 0.72% P on a dry weight basis. Activated sludge from systems with organic removal rates in the range of 0.1-42.5 lb COD/lb VSS/day contained 2.62% P on a volatile solids basis. From a determination of the yield, endogenous decay rate, sludge phosphorus content and variation of removal efficiency with loading it was concluded that phosphorus removal by biological means would always be 20% or less for an influent phosphorus concentration of 9 mg/l P. At low loadings the phosphorus removal would be less than 20% because of the increased significance of endogenous respiration in determining the net growth in the system. Chemical precipitation as a calcium phosphate followed by sorption on the activated sludge floc has been suggested as a mechanism for the enhanced phosphorus removal observed at plants such as San Antonio, Texas. The equilibrium phosphorus content of sewages could be accurately predicted by assuming the precipitation of CaHPO4 (K sub sp = 2.2 x 10 to the minus 7th power). (Aguirre-Texas)
W70-08983

THE INFLUENCE OF INCREASED TEMPERATURES (30-39 DEG) ON THE BIOCOENOSIS OF ACTIVATED SLUDGE AND THE INTENSITY OF DECOMPOSITION OF ORGANIC COMPOUNDS,
C. Rogovskaya, M. Lagareva, and L. Kostina.
Advances in Water Pollution Research, Proceedings, Fourth International Conference on Water Pollution Research, Prague, April 21-25, 1969, London, Pergamon Press, 1969, p 465-476.

Descriptors: *Activated sludge, *Effects, *Temperature, Biodegradation, Biological treatment, Industrial wastes, Organic compounds.
Identifiers: Biocoenosis.

The influence of increased temperatures of the medium was studied considering the following factors: (1) the biochemical oxidation of organic compounds which are often found in industrial wastes-formaldehyde, acetone, and phenol; (2) the composition of the microfauna of activated sludge and its microflora according to physiological groups and the identification of bacteria; (3) activated sludge yield; (4) sludge index; (5) settlement of the suspended matter in the secondary sedimentation tank; (6) nitrification; and (7) the air used when the concentration of dissolved oxygen in the secondary sedimentation tank was 2.5-3.0 mg/l. The purification of industrial wastes under increased temperatures (up to 39 deg C) is possible. An increase in temperature causes the size of the bacterial cells and the specific composition of microflora and microfauna to decrease. The adaptation of bacteria to increased temperatures was slower than the adaptation to toxic compounds. The optimal temperature for nitrifying bacteria was 30-35 deg C. With an increase in temperature the number of microfauna species of the active sludge decreased (from 21 species at 20 deg C to 4-5 at 39 deg C). The growth of sludge decreases with an increase in temperature (sludge treating 600 mg/l formaldehyde) at 32 deg C did not produce excess sludge. With a rise in temperature the sludge index had a tendency to increase (from 56 ml/g at 20 deg C to 93 ml/g at 39 deg C). Wash-out of suspended particles from the secondary sedimentation tank was inconsequential at all temperatures studied, but it tended to decrease with a rise in temperature. The biochemical activity of sludge increased with a rise in temperature (0.916 g BOD removed per gram of sludge/day at 39 deg C and 0.597 g at 20 deg C). (Aguirre-Texas)
W70-08984

RECOVERY OF POLLUTED WATER,
Ontario Water Resources Commission, Toronto.
Great Lakes Water Quality Surveys Program.
For primary bibliographic entry see Field 05G.
W70-08988

WATER SUPPLY AUGMENTATION BY REUSE,
Utah Water Research Lab., Logan.
David W. Hendricks, and Jay M. Bagley.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 247-259, 1969. 5 fig, 1 tab, 6 ref.

Descriptors: *Water reuse, *Water resources development, *Planning, Water yield improvement, Water supply, Conjunctive use, Reclaimed water, Water conservation, Water treatment, Water utilization, Water demand.
Identifiers: Water recycling.

Development of water supplies should include considerations of recycling as an intensive option to be thoroughly explored prior to adoption of an extensive option, usually large scale transport. The potential of recycle is examined as a formal option in water resources planning. Major emphasis is on the conceptual aspects of recycle in the water planning context; the concept is illustrated by means of a case study for an arid region having both large non-consumptive and large consumptive diversions. (See also W70-08597)
W70-08999

5F. Water Treatment and Quality Alteration

REVERSE OSMOSIS CAN CUT COST OF WATER TREATMENT,
Gulf General Atomic, Inc., San Diego, Calif.
J. H. Meyers.
Industrial Water Engineering, Vol 7, No 3, p 25-30, March 1970. 3 fig, 4 tab.

Descriptors: *Optimization, *Design, *Economic feasibility, *Reverse osmosis, *Water treatment, *Costs, Water quality control, Demineralization.

The mass production of uniform-quality membranes was said to be the main item responsible for the popularity and competitiveness of installation of industrial reverse osmosis. The membrane as the heart of the RO system had the characteristics of permitting the passage of water while acting as a barrier to the passage of dissolved or suspended solids. Long-term performance was basic to the value of the reverse osmosis system and it was important that the total installation, including pretreatment, be designed for optimum performance and high availability. In-plant experience gathered over the past two years served as a basis to help insure good overall design and determine economic feasibility. The primary factors that determined performance of reverse osmosis were: (1) applied pressure; (2) concentration of the dissolved solids in the feed; (3) temperature of the feed; and (4) the porosity or permeability of the membrane. To assure optimum performance over long periods the feed was pretreatd by filtration and chemical addition. The major use for reverse osmosis was for the production of high-purity demineralized water. The application offered flexibility in producing water of many qualities for various plant requirements. The components of the RO system installation were described. The capital and operating costs of reverse osmosis equipment decreased significantly as size increased. Typical capital and operating costs for a range of capacities were shown. (Kriss-Cornell)
W70-08851

APPLICATION OF MICROSTRAINER TO WATER TREATMENT AT NAGPUR (INDIA),
Central Public Health Engineering Research Inst., Ahmedabad (India).
M. Parabrahman, J. S. S. Lakshiminarayana, and M. V. Bopardikar.
Water Research, Vol 1, No 3, p 225-231, March 1968. 1 fig, 6 tab, 7 ref.

Descriptors: *Water treatment, *Phytoplankton, Turbidity, Diatoms, Efficiency, Chlorine.
Identifiers: *Microstrainer, *Suspended solids, *Algal counts, *Quality, Filtrability index.

The efficacy is dealt with of microstraining in the treatment of lake waters for drinking purposes. One Glenfield Standard unit, having a drum 2 1/2 ft. diameter and 2 ft wide enclosed by a mild steel tank was installed on the bank of Ambazari lake (India). The flow of wash water as well as microstrained water was measured with 'V' Notchweirs. Analyses and the methods employed were similar to APHA Standard methods, 1955. Filtrameter was used to determine the filtrability index (FI) and Laemocytometer was used for algal counts. There were no differences in pH, chlorides, and alkalinity between raw and microstrained waters tested. On an average, the turbidity of the water varied from 10.4 to 500 ppm and that of microstrained water from 7 to 2 ppm. The percentage reductions in suspended solids due to microstraining ranged from a minimum of 8.3 to 8.7. The average monthly reduction in FI ranged from 62.7 to 81.5. The percentage reduction in algal growth due to microstraining varied from 75 to 94. On the whole, microstraining works well for algae removal. Reduction in the chlorine demand of the raw water was noted if it was microstrained. (Shankar-Texas)
W70-08898

SEPARATION OF PHENOLS IN WATERS BY THIN LAYER CHROMATOGRAPHY,
National Research Centre, Cairo (Egypt). Water Pollution Dept.
Osman M. Aly.
Water Research, Vol 2, p 587-595, 1968. 3 fig, 3 tab, 36 ref.

Descriptors: *Phenol, *Chromatography, *Silica, Chlorination, Analytical techniques, *Potable water, Odor, Taste.
Identifiers: *Thin layer, *Technique, *Solvent system, Gel plates, RF values.

The separation of phenol in natural and waste water by thin layer chromatography to erradicate the objectionable taste and odors they impart to water especially after chlorination is described. Phenols are separated on thin layers of silica as their 4-aminoantipyrine or p-nitrophenylazo dyes. The antipyrl dyes are prepared by the condensation of phenols with aminoantipyrine in the presence of alkaline oxidizing agents. The azo dyes are prepared by coupling of phenols and p-nitrobenzene diazonium fluoborate. The antipyrine dyes were chromatographed on neutral silica gel plates and p-nitrophenylazo dyes on basic silica gel plates. Plates were developed by the ascending

technique at room temperature. (20-25 deg C). After chromatography, the plates were dried and the spots were colored. Solvent systems used in the technique are listed. The RF values of 4 aminoantipyrine derivatives of various phenol and p-nitrophenylazo dyes derived from different phenols are presented. It is concluded that a wide variety of phenols could be separated and identified by combination of two methods. The above technique was used for the identification of chlorination products of phenols in waters. (Shankar-Texas)
W70-08901

PROSPECTS FOR TREATING WATER FROM NUCLEAR ELECTRIC POWER STATIONS WITH PULVERIZED IONITES,
O. I. Martynova, N. P. Subbotina, and A. S. Kopylov.
Available from the Clearinghouse as JPRS-49539, $3.00 in paper copy, $0.65 in microfiche. Translated from Atomnaya Energiya. Translation JPRS-49539 2 Jan 70, 9 p, 9 ref.

Descriptors: Nuclear power plants, *Radioactive wastes, Filters, Ion exchange, Resins.
Identifiers: Ionites, USSR.

The purification of reactor water at atomic power stations whose principal purpose is the removal of corrosion products forming in the first loop and reducing the radioactivity of water, must ensure the removal of impurities present in coarsely dispersed, colloidal and ionized states, and therefore provision is made for both the clarification and ionization of water. Thus a discussion of the use of ionite filters is presented.
W70-09007

5G. Water Quality Control

WATERS FOR WATERFLOODING SAN JOAQUIN VALLEY, CALIF, PETROLEUM RESERVOIRS,
Bureau of Mines, San Francisco, Calif. Petroleum Research Office.
For primary bibliographic entry see Field 02K.
W70-08587

ADVANCES IN WATER POLLUTION RESEARCH.

Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, 1969. 936 p.

Descriptors: *Water resources, *Water pollution control, *Research equipment, *Analytical techniques, Water quality, Dissolved oxygen, Biochemical oxygen demand, Suspended load, Wastes, Sewage, Algae, Microorganisms, Phosphates, Hydrogenation, Aeration, Flocculation, Filtration, Model studies, Computers, Nutrients, Eutrophication.
Identifiers: *Water pollution research.

This volume contains the 53 original papers presented at the Fourth International Conference on Water Pollution Research held in Prague in April, 1969. Among the topics discussed are the self-purification of polluted rivers that have been artificially canalized, the factors that influence pollution under these conditions, and methods for predicting the extent of pollution and the distribution of dissolved oxygen in rivers. Computers may be used to analyze various alternative means of obtaining river water of required quality. The most important contribution towards pollution control is made by purifying sewage and other waste water. Purified sewage is an important source of the mineral nutrient requirements of microrganisms especially algae, and pollution control must include nutrient removal from effluents. (Woodard-USGS)
W70-08627

THE COURSE OF SELF-PURIFICATION PROCESS OF CANALIZED HIGHLY POLLUTED RIVERS,
Water Protection Research Section, Breslau (Poland).
Henry Manczak.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 1-13, 1969. 13 p, 10 fig, 14 ref, append.

Descriptors: *Self-purification, *Canals, *Water pollution, *Rivers, Impounded waters, Ice, Low flow, Biochemical oxygen demand, Dissolved oxygen, Equations, Path of pollutants, Streamflow.
Identifiers: Odra River (Poland).

The Odra River in Poland has a canalized water course during the navigable season, and is a free-flowing natural river in the post-navigable period. These circumstances made it possible to study the differences in self-purification of an impounded and free-flowing water course at the time of ice covering, when the river is free of ice, and also during low flow in the summer with a higher water temperature. Within a distance of 264 km along the river, 120 control stations were located, where 1440 samples were taken. The time of passage had been previously determined by means of a radioactive tracer (Br-82). (Woodard-USGS)
W70-08629

BOUNDARY LAYER EFFECT ON THE COURSE OF THE SELF-PURIFICATION OF SMALL STREAMS,
Hydraulic Research Inst., Brno (Czechoslovakia).
Vladimir Novotny.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 39-50, 1969. 12 p, 3 fig, 3 tab, 18 ref.

Descriptors: *Water pollution, *Boundary layers, *Effects, *Self-purification, *Streams, Mass transfer, Oxygen, Diffusion, Streambeds, Banks, Foreign research.
Identifiers: Deoxygenation coefficient, Czechoslovakia.

The relationship between the deoxygenation coefficient of rivers and the hydraulic conditions of flow was studied. Every mass transfer between benthic organisms and flowing water must take place through the diffusive boundary later. The velocity of the slowest process during the mass transfer is then the limiting factor for the intensity of the biochemical activity of these organisms; this also determines whether the processes in the benthal layer are aerobic or anaerobic. In the same way changes of the chemical composition of water may be explained. The classification of rivers into categories according to the degree of self-purification makes it possible to compare values for the deoxygenation coefficient in observation and theory in order to test whether the relationships obtained are in good agreement with reality. (Woodard-USGS)
W70-08631

WATER QUALITY PROTECTION PLANS IN RIVER BASINS,
Institute of Hydrotechnical Research, Bucharest (Rumania). Surface Water Lab.
Radu Antoniu.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969; London, Pergamon Press, Ltd, p 23-29, 1969. 7 p, 3 fig, 7 ref.

Descriptors: *Water quality control, *Watershed management, *River basins, *Standards, *Legislation, Water pollution, Biochemical oxygen demand, Dissolved oxygen, Foreign research, Water management (Applied), Water law.
Identifiers: *Romania.

In Romania, a law was enacted on 'Quality Conditions of Surface Waters' to initiate the elaboration of plans for protection of water quality in the river basins of the country. The scientific basis for control measures in the water quality protection is provided by research conducted since 1960 in the Surface Water Laboratory at the Institute of Hydrotechnical Research, Bucharest. These investigations include physical, chemical, biological and bacteriological studies in the main river basins of the country, and the development of new standards and guidelines. Categories in determining the water quality requirements of a stream are potable water supplies; water used for urban or recreation purposes; and irrigation and industrial water supplies. The basic indicators used in water quality protection plans for the rivers Olt, Arges, and Siret were 5-day biochemical oxygen demand, dissolved oxygen, and toxic substances. A drawing showing major water uses and sources of pollution in the Olt River Basin and a graph showing values of BOD and DO proposed for the year 1980 are included. (Woodard-USGS)
W70-08632

STREAM REAERATION USING MOLECULAR OXYGEN,
Crown Zellerbach Corp., Camas, Wash. Dept. of Manufacturing Services.
Herman R. Amberg.
In: Advances in Water Pollution Research, Proceedings 4th International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, p 291-298, 1969. 8 p, 2 fig, 3 tab, 5 ref.

Descriptors: *Reaeration, *Dissolved oxygen, *Oxygenation, *Streams, Diffusion, Application methods, Feasibility, Costs, Oregon, Louisiana, Water pollution treatment, Water pollution control, Water quality control.
Identifiers: *Molecular oxygen.

Experiments were designed to determine the feasibility of adding substantial quantities of dissolved oxygen to streams by means of two different aeration methods. In the Willamette River in Oregon, molecular oxygen was vented into the water passing through a power turbine. In the Pearl River in Louisiana oxygen was diffused through a multiport header on the bottom of the stream. Addition of oxygen to a power turbine resulted in oxygen absorption efficiencies of 39% when the water coming to the turbine was 81% saturated. Addition of oxygen to the turbine was relatively simple and inexpensive, whereas the use of a diffuser header resulted in a much lower oxygen absorption efficiency and was much more complicated and expensive. It is doubtful whether oxygen absorption efficiencies in excess of 20% can be attained with a well designed diffuser header placed along the stream bottom. Oxygen requirements and costs for various oxygen addition rates for power turbine and aeration header applications are tabulated. (Woodard-USGS)
W70-08644

INVESTIGATIONS OF THE RESIDUES OF CHLORINATED INSECTICIDES IN GROUNDWATER (In Italian),
Florence Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 05B.
W70-08659

RESEARCH OF THE RESIDUES OF CHLORINATED INSECTICIDES IN THE SURFACE WATER USED FOR DRINKING (In Italian),
Florence Univ. (Italy). Inst. of Hygiene.
For primary bibliographic entry see Field 05B.
W70-08660

COLE V PENNSYLVANIA PUB UTIL COMM'N (ADMINISTRATIVE CONTROL OF WATER SUPPLY AND QUALITY).

146 Pa Super 257, 23 A2d 121-124 (1941).

Descriptors: *Pennsylvania, *Regulation, *Water supply, *Administrative agencies, Utilities, Water works, Pipes, Reservoirs, Filtration, Pumping, Costs, Judicial decisions, Legal aspects, Water management (Applied), Water purification, Filters, Public health, Permits, Water quality control, Administrative decisions, Water treatment.

Plaintiffs were receiving raw, unfiltered water from a water supply company at little or no cost. The water company's permit from defendant Public Utility Commission to supply water was given upon condition that all water supplied be filtered. Plaintiffs were connected into the company's mains at a point above its filtration plant. Upon discovery of non-compliance with the permit and refusal of the water company to build a line back from its filtration plant which would enable plaintiffs to receive filtered water, defendant ordered plaintiffs' water supply discontinued. Plaintiffs asked defendant to require the water company to continue service to them. The Commission held that it was unlawful for the company to serve unfiltered water to the public and that it was unreasonable, in light of the expense involved, to require the company to serve filtered water to plaintiffs. Plaintiffs appealed to the superior court, which held that the question to be decided was an administrative one which was within the sound judgment and discretion of defendant, and its decision, which was based upon substantial evidence, was not to be disturbed. (Barnett-Florida)
W70-08664

ANNEBERG V KURTZ (RIGHT TO MAINTAIN A PRIVATE NUISANCE OBTAINED BY PRESCRIPTION).
28 SE2d 769-773 (Ga 1944).

Descriptors: *Georgia, *Prescriptive rights, *Canneries, *Pollution abatement, Easements, Downstream, Non-navigable waters, Decomposing organic matter, Legal aspects, Relative rights, Riparian rights, Riparian waters, Watercourses (Legal), Legislation, Disposal, Pollutants, Water pollution effects, Water pollution sources, Mills, Damages, Remedies.
Identifiers: *Nuisance (Private).

Plaintiff lower riparian landowner sought to enjoin defendant upper riparian cannery from polluting the non-navigable stream flowing across both lands. Plaintiff also sought damages alleged to have occurred from the resultant interference with operation of her grist mill. Defendant, who had discarded tomato peels and other debris into the stream for thirty-three years, contended he had thereby acquired a prescriptive right to so sue the stream and the land through which it flowed. The appellate court held that the right to maintain a private nuisance can be acquired by prescription and that the defendant had acquired such a prescriptive right. The decree appealed from was affirmed. (Price-Florida)
W70-08680

PLANNING FOR WATER QUALITY EMERGENCIES,
For primary bibliographic entry see Field 06E.
W70-08800

THE USE OF DIGITAL SYSTEMS MODELING IN THE EVALUATION OF REGIONAL WATER QUALITY INVOLVING SINGLE OR MULTIPLE RELEASES,
Battelle Northwest, Richland, Wash. Pacific Northwest Lab
For primary bibliographic entry see Field 05B.
W70-08828

THERMAL POLLUTION, THE SHARP HORNS OF A NATIONAL DILEMMA,
Consolidated Edison Co. of New York, Inc., New York.
Charles F. Luce.
Water Spectrum, Vol 2, No 2, p 19-23, Summer 1970. 3 fig.

Descriptors: *Thermal pollution, *Electric power industry, *Electric power demand, *Cooling water, *Impaired water quality, Environment, Ecology, Powerplants, Water cooling.
Identifiers: *Closed cycle dry cooling.

Dealing with increasing thermal pollution problems, the author had nine propositions as follows: (1) We must protect the quality of waters. (2) The Nation's demand for electric energy will continue to increase at a rapid rate and this demand must be met. (3) To some extent, to build a power supply will impinge upon the environment. (4) The question of how much alternation of the ecology we are willing to accept as the price of a new power supply is the key question. (5) The resolution of tese questions should be the same whether the electric utility is investor-owned or publicly owned. (6) Nuclear generating stations do not present a new thermal discharge problem. (7) In meeting the power demand, the cooling capacity of many waters will be exceeded in the near future. (8) Eventually it will be necessary to develop closed cycle dry cooling devices. (9) Research is needed in developing less expensive and less bulky cooling facilities. It is emphasized that it is important to determine the actual ecological changes caused by thermal discharge. (Osborne-Vanderbilt)
W70-08829

USES OF WASTE HEAT,
Oak Ridge National Lab., Tenn.
Sam E. Beall.
Oak Ridge National Laboratory Review, Vol 3, No 4, p 9-14, Spring 1970.

Descriptors: *Thermal pollution, *Greenhouses, Water temperature, Powerplants, Distillation, Algae, Aquiculture, Fish, Shellfish, Crustaceans, Oysters, Seasonal.
Identifiers: *Waste heat, Thermal efficiency, Heat consumption.

Waste heat from powerplants which would normally add to the problem of thermal pollution can be reused for a profit. One use of this waste heat would be as a substitute for electricity in low-temperature industrial uses. Waste heat can be used for air cooling in ammonia or lithium bromide air conditioning systems during the summer when thermal releases need to be reduced the most. Another use of waste heat would be in the evaporation of waste water to allow reuse of the valuable water. Similarly, distillation of salt water or brackish water could make use of waste heat. The best possible use would be in the heating and cooling of greenhouses and poultry houses located on the reactor exclusion area. However, aquiculture pond heating promises large profits in the high yields of fish, shellfish, and crustaceans. Further study on the subject of waste heat reuse is being done in the Pacific Northwest where irrigation uses are being considered. (Osborne-Vanderbilt)
W70-08832

COMPUTER MODEL OF CONNECTICUT RIVER POLLUTION,
United Aircraft Corp., East Hartford, Conn. Research Labs.
Thomas E. Hoover, and Robert A. Arnoldi.
Journal of Water Pollution Control Federation, Vol 42, No 2, Part 2, p R67-R75, Feb 1970. 4 fig, 1 tab, 11 ref.

Descriptors: *Computer models, *Pollutant identification, *Biochemical oxygen demand, *Dissolved oxygen, *Temperature, Connecticut, Physical properties, Equations, *Digital Computers, Delaware River, *Mathematical models, *Simulation analysis.

The object of the study was to adapt the Deleware River program to produce a computer model of the Connecticut River within the state of Connecticut. This model would make use of the best information available describing physical conditions, such as flow volumes and sounding depths, as well as the latest pollution data describing DO, BOD, and temperature. Such a model made it possible to predict the effect of waste water input, artificial aeration, and temperature on the overall water purity. Equations describing aeration, photosynthesis, and bacterial decay were used in the model to calculate changes in DO and BOD concentrations in time. For model construction, the river was partitioned along its length into thirty-nine sections, each of which was assumed to be completely mixed with a uniform concentration of DO and BOD. This made it possible to use a simple one-dimensional mathematical model suited ideally to digital computation. The predicted DO and BOD concentrations in the Connecticut were presented. (Kriss-Cornell)
W70-08843

EVALUATION OF ALTERNATIVE SOLUTIONS FOR ACHIEVEMENT OF RIVER STANDARDS,
Quirk, Lawler and Matusky, New York.
Thomas P. Quirk, and Leonard J. Eder.
Journal of Water Pollution Control Federation, Vol 42, No 2, Part 1, p 272-290, Feb 1970. 16 fig, 3 tab.

Descriptors: *Mathematical models, *Computers, *Simulation analysis, *Water quality control, *River systems, Biochemical Oxygen demand, Dissolved oxygen.

The objectives of the study were: (1) the determination of the river's physical characteristics; (2) development of a mathematical simulation model of the river to predict BOD and DO profiles under any condition of flow, temperature, or waste discharge; (3) application of the simulation model to investigate in detail: (a) BOD assimilation capacity under critical weather and flow conditions and (b) the effects of sludge deposits, hydro-turbine venting and flow augmentation; (4) development of the comparative economics of alternative solutions for achievement of proposed water quality standards. The river studied was approximately 170 miles (274 km) in length with a drainage area of 3,500 sq miles (9,065 km). The major river characteristics involved were summarized. The composite effect yielded a discontinious river system physically, hydraulically, and biologically, requiring lengthy calculations for manual determination of assimilation capacity. Development of a mathematical simulation model and computer solution was indicated. A system analysis approach was utilized and the general procedure was described. Component models for oxygen input and oxygen consumption was shown and were grouped in terms of the basis used for flow regimen description. A composite model for river simulation was constructed by summing the components shown and the simulation as seen by the computer was illustrated. (Kriss-Cornell)
W70-08846

ECONOMICS OF THERMAL DISCHARGES,
Colorado State Univ., Fort Collins.
George Lof, and John Ward.
Industrial Water Engineering, Vol 7, No 1, p 12-18, Jan 1970. 5 fig, 10 ref.

Descriptors: *Economics, *Downstream, *Cooling water, Water quality, Chemicals, *Capital costs, *Operating costs, *Temperature.
Identifiers: *Thermal discharges.

Economic implications of thermal discharges were examined. The discharges from power plants and the potential effect that the discharges have on downstream water-users, that is, on downstream water used for cooling purposes, were described. It was pointed out in the literature that the temperature of water used for cooling purposes was often of more significance that the composition and chemical quality of water. The main objective was to indicate the approximate range of costs involved in

completely preventing thermal discharge; i.e., by circulating water through cooling towers, and to show the approximate costs to a downstream power plant being forced to use cooling water containing thermal discharges from an upstream electric station. The cost of cooling water recirculation included capital costs, primarily of the cooling tower installation, and operating costs, which were the make-up water, chemicals, and power for operating fans and pumps. The capital costs were dependent upon water flow required, prevailing wet bulb temperature of the air, the water temperature change through the tower, and the temperature of water delivery from the cooling tower to the condenser. The capital cost of the cooling tower installation was estimated from charts and tables and an example was given. Economic consequences of thermal discharge, such as water loss by evaporation, were discussed. (Kriss-Cornell)
W70-08852

WATER QUALITY CONTROL IN CALIFORNIA,
California State Water Resources Control Board, Sacramento.
Norman B. Hume.
ASCE Proceedings, Journal of the Sanitary Engineering Division, Vol 96, No SA4, Paper 7448, p 873-884, August 1970.

Descriptors: *Water quality control, *Legislation, *California, Water pollution control, Aesthetics, Water law, Water management (Applied), Water pollution, Water quality, Waste disposal.
Identifiers: Water quality legislation.

The Porter-Cologne Water Quality Control Act, effective January 1, 1970, completely revises California's 20 yr-old water pollution control law. Esthetics and protection of fish and wildlife have been added to beneficial uses of water to be protected. Area-wide planning for the solution to water pollution problems is encouraged. The interrelationships of water quality and water quantity as expressed by water rights are recognized. The State Water Resources Control Board now administers the related functions of water rights determination and water quality control. The State Board establishes policy and guidelines for nine Regional Water Quality Control Boards. The regional boards adopt water quality control plans and establish waste discharge requirements to meet the water quality objectives enunciated in the water quality control plans which must be approved by the State Board. Violators of waste discharge requirements may now be assessed civil penalties of up to $6,000 per day for each day of violation. (Knapp-USGS)
W70-08943

MODEL OF NATURAL DRAFT COOLING TOWER PERFORMANCE,
Federal Water Quality Administration, Corvallis, Oreg. Pacific Northwest Water Lab.
For primary bibliographic entry see Field 05D.
W70-08945

RECOVERY OF POLLUTED WATER,
Ontario Water Resources Commission, Toronto. Great Lakes Water Quality Surveys Program.
W. A. Steggles.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 163-169. 13 ref.

Descriptors: *Water pollution control, *Economics, *Water quality control, *Water costs, Water management (Applied), Social aspects, Water law, Governments.
Identifiers: St. Lawrence Basin, North America.

Economic and other losses due to pollution in North America are examined including the socio-economic costs of improvements using existing technology. Canadian experiences in the Province of Ontario portion of the Great Lakes-St. Lawrenc Basin are reviewed as an example of the alternatives being considered in water management to bring the forces of improved technology to bear on augmenting the water supply through pollution control. The power and potential of basin-wide water management is considered as a device to achieve the often conflicting objectives of economic growth and maintenance of quality of the environment. (See also W70-08597)
W70-08988

PHYSIOGRAPHY-LAND USE INTERACTIONS IN WATERSHED MANAGEMENT,
British Columbia Univ., Vancouver. Dept. of Forestry.
For primary bibliographic entry see Field 05B.
W70-08989

ELKHART LAKE, WISCONSIN COMPREHENSIVE PLAN.
Wisconsin State Dept. of Local Affairs and Development, Madison. Bureau of Local and Regional Planning.
For primary bibliographic entry see Field 06A.
W70-09004

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

TIME-CAPACITY EXPANSION OF URBAN WATER SYSTEMS,
Stanford Research Inst., Menlo Park, Calif.
Russell F. Scarato.
Water Resources Research Vol 5, p 929-936, October 1969, 8 p, 4 fig, 8 ref.

Descriptors: *Costs, *Capital investment, *Economics, *Water resource development, Water supply, Interest rate, Water demand, Planning, Financing, Budgeting, Water treatment, Capital costs, Rate of growth, Model studies, Technology, Optimization, Cost minimization, Pipelines.
Identifiers: *Economies of scale, *Water investment, *Pipeline size, Discount rate, Excess capacity.

The criteria for providing insight into the timing and capacity expansion decisions of a water facility are developed in this paper. A time-capacity expansion model is applied to two independent decisions: pipelines and water treatment. The model is a general minimum cost types, applied to time and size component expansion needed to meet an exogenously determined water system growth rate. It analyzes the economic impact of both the economies of scale in construction and the real cost of capital. The economic effects of timing and sizing decisions on total costs are plotted for various interest rates and levels of economies of scale. The model used is the one developed by Manne. As adapted by the author, the model shows that capital savings are available in urban water investments by establishing the initial design size and timing specifications of a proposal after quantitatively analyzing the effects of economies of scale and cost of capital under conditions of growth. (Murphy-Rutgers)
W70-08692

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
J. C. Flinn, and J. W. B. Guise.
Water Resources Research Vol 6, No 2, p 398-409, April 1970.

Descriptors: *Water supply, *Prices, *River basin, *Optimization, Model studies, Economic analysis, Distribution, Social aspects, Maximization, Demand, Planning, Marginal cost, Agricultural water, Industrial water, Water pricing, Decision-making.
Identifiers: *Spatial equilibriom, *Social welfare.

The purpose of this paper is to demonstrate that the interregional equilibrium models developed by Takayama and Judge may be adapted to determine the efficient allocation and pricing of water in a river basin. It is assumed that the authority responsible for the allocation and pricing seeks a policy that will ensure that social welfare in relation to the available water supply is maximized. The capacity of the authority to supply water within any time period is assumed to be constrained by the physical structure of the system. The potential usefulness of such a model is demonstrated and the results discussed. The authors show that models of this type have considerable potential for empirical research in the field of water resources. (Murphy-Rutgers)
W70-08693

ECONOMETRICS OF JOINT PRODUCTION: A COMMENT,
Columbia Univ., New York.
V. K. Chetty.
Econometrica, Vol 37, No 4, p 731, October 1969. 1 ref.

Descriptors: Statistical methods, Least squares method, Regression analysis.
Identifiers: *Econometrics, Canonical correlation, Joint production.

In a recent paper, H D Vinod has suggested the use of canonical correlation techniques for the estimation of joint production functions. He has also argued that the least squares estimates of the joint production functions are inconsistent. In this note, it is demonstrated that the canonical correlation and the least squares methods yield the same estimates of the joint production functions, and that his proof of the inconsistency of the least squares estimates is erroneous. This article would be of interest to the water researcher attempting to develop a joint production model for water supply. (Loeb-Rutgers)
W70-08706

A NOTE ON ECONOMETRICS OF JOINT PRODUCTION,
Chicago Univ., Ill.
Potluri Rao.
Econometrica, Vol 37, No 4, p 737-738, October 1969. 3 ref.

Descriptors: Economics, Technology.
Identifiers: *Econometrics, *Joint production, Canonical correlation, Restrictions, Multiple products, Aggregation, Transformation curve.

In a recent paper, H C Vinod suggested a canonical correlations technique for estimating joint production processes. Estimates from such a procedure have economic interpretation only under certain restrictive assumptions. The purpose of this note is to point out these restrictions. Joint production includes two cases: (1) when there are multiple products, each produced under separate production process; and (2) when there is joint production, i.e., when several outputs are produced from a single production process. This may prove useful in the water area when applying econometric methods to estimate relations that reflect the joint production aspect of water supply. (Loeb-Rutgers)
W70-08707

ANALYSIS OF INVESTMENT RETURNS BY COMPUTER,
Michigan Univ., Ann Arbor.
James C. T. Mayo, and David Knoll.
The Engineering Economist, Vol 12, No 4, p 229-239, Summer 1967. 2 fig, 8 ref, 1 append.

Descriptors: *Computers, Costs, Investment, Computer programs.

Identifiers: *Investment returns, *Internal rate of return, Rate of return, Multiple rates, Pure investment, Mixed investment.

In the theory of financial management, the internal rate of return is frequently regarded as the true rate of return. This is because the rate is supposed to be independent of the firm's cost of capital, and, therefore, internal to the investment. However, as Teichroew, Robicheck, and Montalbano point out, this assumption of independence does not hold for all investments. If the cash expenditures of an investment are not restricted to the initial period, the investment return may vary directly with the firm's cost of capital. Moreover, these subsequent outlays may cause the project to have multiple internal rate of returns. Teichroew, Robicheck, and Montalbano have provided the theoretical concepts for understanding investments with multiple internal rate of returns and for calculating the functional relationship between project return and cost of captial for such investments. This paper presents a computer program of implementing Teichroew's, Robicheck's, and Montalbano's theoretical analysis and to illustrate the usefulness of the program with meaningful examples. This article has relevance to water investment and rate of return problems. (Loeb-Rutgers)
W70-08708

MODELING AND PREDICTING HUMAN RESPONSE TO THE VISUAL RECREATION ENVIRONMENT,
Northwestern Univ., Evanston, Ill., and Corps of Engineers, Washington, D.C.
George L. Peterson, and Edward S. Neumann.
Journal of Leisure Research, Vol 1, No 3, p 219-237, Summer 1969. 5 fig, 4 tab, 5 ref.

Descriptors: *Forecasting, *Preferences, Swimming, Model studies, Statistical methods, Lake Michigan, Photography, Beaches, Recreation, Recreation facilities, Psychological aspects, Estimating.
Identifiers: *Modeling, *Human response, Natural beaches, Crowding, City swimming beaches, Subjective responses, Recreation environment, Factor analysis.

The purpose of this paper is to develop and apply a conceptual and methodological approach for analyzing subjective response to the appearance of the recreation environment. The conceptual framework employs a mathematical preference model to hypothesize and quantify a man-environment relationship. To obtain data for the model, recreation environments were sumulated by photos and responses classified by techniques of psychological measurement. The preference functions should be sensitive to differences in characteristics of alternative environments as well as to differences in people's responses to the same environmental conditions. It is hypothesized that such responses are influenced by measurable factors such as life style, social rank, culture rank, culture, and personality. The model is demonstrated using Lake Michigan beaches. Results show that two groups with different preferences are identifiable. The larger group prefers scenic natural beaches and the smaller prefers city swimming beaches. The study shows conflicting user preferences for the characteristics of beaches. Studies of this nature would be helpful to the water planner in determining the types of recreation facilities that should be provided. (Loeb-Rutgers)
W70-08709

THE ANALYSIS AND EVALUATION OF PUBLIC EXPENDITURES: THE PPB SYSTEM, A COMPENDIUM OF PAPERS SUBMITTED TO THE SUBCOMMITTEE ON ECONOMY IN GOVERNMENT OF THE JOINT ECONOMIC COMMITTEE.
Joint Committee on Economics (U.S. Congress). Subcommittee on Economy in Government.
Available from the Superintendent of Documents, Wash. D.C.: Vol 1, $2.75, Vol 2, $0.75, Vol 3, $1.75. Economic Joint Committee, Joint Committee Print, US Government Printing Office, Washington, DC, 1969. 124 p, 3 vols.

Descriptors: *Planning, *Budgets, *Economic evaluation, *Forecasting, Government, Resource allocation, Prices, Costs, Benefits, Economic efficiency, Decision-making, Water pollution optimization, Risk, Uncertainty, Data collection, Regional analysis.
Identifiers: *Programing, Budgeting, Institutional factors, Multiple objectives, Agency experience, Social overhead.

This is a three volume report on the use of the Planning, Programming and Budgeting (PPB) System in the analysis and evaluation of government expenditures. The study is divided into six parts. Part I considers the issues of economics and equity pertinent to governmental market decisions. The papers in Part II attempt to isolate the factors effecting governmental efficiency in expenditures. In Part III a few of the key problems in applying economic analysis in the public sector are discussed. Part IV is a comprehensive discussion of the PPB System in the Federal Bovernment. The papers in Part V appraise and evaluate the structure and performance of PPB to date. Those in Part VI direct attention to the major issues for policy analysis in each of the primary functional areas of the Federal budget. The large role played by government in the water resources area makes the PPB System described of use in the analysis and evaluation of government water resources investments. (Murphy-Rutgers)
W70-08721

SYSTEMS FOR ANALYSIS: PPB AND ITS ALTERNATIVES,
Brookings Institution, Washington, D.C.
Allen Schick.
In The Analysis and Evaluation of Public Expenditures: The PPB System, a compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee, US Government Printing Office, Washington, DC, 1969, Vol III, p 817-834.

Descriptors: *Systems analysis, *Economic evaluation, *Government, *Budgeting, *Planning, Programing, Management, Economic efficiency, Social aspects, Costs, Benefits, Decision-making, Time.
Identifiers: *PPB System, Program effectiveness, Public benefits, Crosswalk system, Two-track system, Policy planning.

The author examines the strength and weakness of the conception of the Planning-Programing-Budgeting (PPB) system relative to alternative approaches to public expenditures analysis. This topic represents an important method of evaluating public water resources investments. The paper considers several difficulties relating to the purpose and scope of policy analysis: (1) The budget process is evaluated as being nonanalytic or antianalytic, (2) Is a systems approach the most effective way to enhance the analytic caliber of public choices. The author feels it may be efficacious to promote analysis without regard for its systems character, (3) Assuming a system approach is justified, the author tries to determine what the mission and scope should be, (4) Finally the author then investigates whether the scope and focus of the analysis should be public benefits or program effectiveness. (Murphy-Rutgers)
W70-08722

TODAY'S PPBS: THE FATAL TRIUMPH OF FINANCIAL MANAGEMENT OVER ECONOMICS,
Veterans Administration, Washington, D.C.
Samuel M. Greenhouse.
In the Analysis and Evaluation of Public Expenditures: The PPB System, a Compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee, US Government Printing Office, Washington DC, 1969, Vol III p 886-898.

Descriptors: *Systems analysis, *Economic evaluation, *Planning, *Programming, *Budgeting, *Government, Forecasting Economic analysis, Decision-making, Management, Costs, Benefits, Value, Prices, Economic efficiency.
Identifiers: *PPBS, Marginal utility, Market system, Executive branch, Opportunity cost.

The emergence of the government as an economic enterprise calls for the development of procedures for the economic evaluation of government enterprise activities. In the area of water resources the government is often the largest investor so that a proper method of evaluation should be of interest to the water researcher. The author shows that an economic form of planning-programming-budgeting system (PPBS) is the procedure needed to replace the financial management type of PPBS presently in use. The marginal utility theory of value, because it provides the government with a conceptual basis upon which to appraise the benefit of an enterprise's individual offerings, is essential to an economic PPBS. Applying this theory calls for identifying the Federal enterprise's final outputs and the customers who receive them. In the last section the paper recommends a specific design including a standardized government-wide program structure and substructure for the economic PPBS. (Murphy-Rutgers)
W70-08723

PUBLIC EXPENDITURE ANALYSIS AND THE INSTITUTIONS OF THE EXECUTIVE BRANCH,
Laird Systems, Los Angeles, Calif.
Fred S. Hoffman.
In The Analysis and Evaluation of Public Expenditures: the PPB System, a compendium of papers submitted to the Subcommittee on Economy In Government of the Joint Economic Committee, Vol, 3 p 925-942, U.S. Government Printing Office, 1969.

Descriptors: *Planning, *Budgeting, *Programing, *Government, *Decision-making, Benefit-cost analysis, Forecasting, Social aspects, Economic efficiency, Multiple-purpose projects, Resource allocation, Risk, Income, Data processing.
Identifiers: *PPB, Executive branch, *Five-year plan.

There are large impediments to sound and objective economic analysis of public water resource investments. This paper, analyzes; 1- the origins of systematic analysis in the Federal Government, 2- the appropriateness and value of this kind of analysis, and 3- the obstacles in the executive branch that are being faced in the introduction of the planning, programing, budgeting, (PPB) system. The author discusses the problems raised by multiobjective programs, the lack of sound theory and the political sensitivity of many programs. The paper concludes with a discussion of a number of suggestions designed to increase the effectiveness of benefit cost information in the decision process. The general discussion of budgeting problems makes this paper relevant to researchers interested in the problems of financing and budgeting water projects. (Murphy-Rutgers)
W70-08724

THE STATUS AND NEXT STEPS FOR PLANNING, PROGRAMING, AND BUDGETING,
Bureau of the Budget, Washington, D.C.
Jack W. Carlson.
In the Analysis and Evaluation of Public Expenditures: The PPB System, a compendium of papers submitted to the Subcommittee on Economy In Government of the Joint Economic Committee, Vol. II, U. S. Government Printing Office, 1969.

Descriptors: *Planning, *Budgeting, Decisionmaking, *Programing, *Government, Forecasting, Economic evaluation, Financing, Costs, Benefits, Economic efficiency, Data collection, Resource allocation, Social aspects.
Identifiers: *PPB, *Program structure, Education, Issue letters, Financial planning.

The purposes of the Planning--Programing-Budgeting system (PPBS) are to aid decision-makers in more effectively allocating limited public resources, to reduce the portion of the budget that is uncontrollable, to understand the actual impact of public programs, to assure the orderly presentation of relevant analysis for decision making, to identify programs that no longer serve national objectives, to integrate long-range objectives with current-year budgets and to connect planning and budgeting with actual performance. These are vital aims in the evaluation of public water resource projects, making this paper of interest to the water researcher. The author argues that PPB has been moderately successful and will contribute a great deal to public policy decisionmaking in the future. In a set of thirteen attachments to the paper, a number of displays pertinent to the structure and functioning of the PPB System are presented. (Murphy-Rutgers)
W70-08725

THE PLANNING, PROGRAMING, AND BUDGETING SYSTEM IN THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE: SOME LESSONS FROM EXPERIENCE,
Brookings Institution, Washington, D.C.
Alice M. Rivlin.
In: The Analysis and Evaluation of Public Expenditures: The PPB System, a compendium of papers submitted to The Subcommittee On Economy In Government of the Joint Economic Committee, Vol 3, p 909-922, U.S. Government Printing Office, 1969.

Descriptors: *Economic evaluation, *Planning, *Programing, *Budgeting, Decision-making, Systems analysis risk, Measurement, Statistics, Education, Project planning, Project purposes, Government.
Identifiers: *Health, Education, and Welfare, *PPB, Planning cycle, Five year plan.

Many of the problems involved in evaluating government programs in the area of health, education and welfare are similar to those encountered in water resources. Thus an insight into the evaluation of the former should be some help in studying budget problems for water projects. The author believes that systematic analysis and program evaluation are important components of an effective agency and efficient programs. The paper describes the evolution of systematic analysis in the Department of Health, Education, and Welfare, describing the program budget and information system, the quantitative evaluation of program accomplishment, the analysis of alternative policy actions and the development of a five year plan in the context of the planning cycle. This type of analysis is able to improve the decision-making process by largely reducing the element of uncertainty involved. The author concludes by stating the necessity of systematic analysis for effective planning and evaluation of government projects. (Murphy-Rutgers)
W70-08726

PRESCRIPTION FOR AN EFFECTIVE GOVERNMENT: ETHICS, ECONOMICS, AND PPBS,
Institute for Defense Analysis, Arlington, Va.
Paul Feldman.
In the Analysis and Evaluation of Public Expenditures: the PPB System, a compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee U S Government Printing Office, Washington, D.C., 1969, Vol III, p 865-885.

Descriptors: *System analysis, *Economic evaluation, *Budgeting, Decision-making, Planning, Forecasting, Economic justification, Government, Taxes, Cost, Benefits, Cost-benefit analysis, Financing, Competition.
Identifiers: *PPB, *Ethical criterion, *Market imperfections, Equilibrium.

This article indicates that since the inception of Planning-Program-Budgeting (PPB) there has been little modification in the substance of budget decision-making. PPB has been used to evaluate government water resource investments and this article should be relevant to the water researcher. The author discusses the reasons for the failure of PPB and points out the necessity of defining an ethical basis for government behavior without which PPB is useless. The paper then specifies an ethical code and draws conclusions regarding the desirable activities of government. A specific proposal is presented which applies these conclusions to the operation of the PPB system. The author finds that government should remove market imperfections and that when government undertakes expenditures it should attempt to distribute the tax burden in accord with the distribution of benefits. The new structure proposed for the PPB system indicates what standards should be used for measurement and in what direction the analysis should proceed. (Murphy-Rutgers)
W70-08727

ECONOMIC ANALYSIS IN NATURAL RESOURCE PROGRAMS,
George Washington Univ., Washington, D.C.
Jack C. Knetsch.
In: The Analysis and Evaluation of Public Expenditures: the PPB system, a compendium of papers submitted to the Subcommittee on Economy in Government of the Joint Economic Committee, U.S. Government Printing Office, Washington, D.C., Vol. III, p. 1087 to 1101.

Descriptors: *Economic analysis, *Cost-benefit analysis, *Natural resource development, *Government, Social aspects, Recreation, Pollution, Economic justification, Demand, Economic efficiency, Planning, Budgeting, Taxes, Forecasting.
Identifiers: *Market criteria, *Nonmarket values.

In this paper the author applies the concepts and techniques of benefit-cost analysis to additional public expenditure issues in natural resources programs. Although most public sector action in the natural resource field is a result of market failure, the author asserts that market criteria can be developed and applied to expenditure policy in this area. The author also appraises the demand studies done in the natural resource area and makes suggestions for improving procedures. He points out the problems related to those outputs of public projects which are difficult to quantify and measure and suggests some principles for improving the estimates of economic demands. The author then discusses the question of divergencies between social costs and benefits and those which fall on a single individual. He argues that the purely local or secondary benefits of public investment projects should not be counted in a national efficiency criterion. Although concerned with all natural resources, the authors comments are directly applicable to water resources. (Murphy-Rutgers)
W70-08728

THE USE OF DIGITAL SYSTEMS MODELING IN THE EVALUATION OF REGIONAL WATER QUALITY INVOLVING SINGLE OR MULTIPLE RELEASES,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W70-08828

A BRANCH-AND-BOUND ALGORITHM FOR MULTI-LEVEL FIXED-CHARGE PROBLEMS,
Research Analysis Corp., McLean, Va.
Arnold P. Jones, and Richard M. Soland.
Management Science: Theory, Vol 16, No 1, p 67-76, September 1969. 1 fig, 2 tab, 9 ref.

Descriptors: *Optimization, *Mathematical models, *Linear programming.
Identifiers: Branch-and-bound algorithm.

Multi-level fixed-charge problems were mathematical optimization problems in which the separable portion of the objective function was the sum of piecewise continuous functions of a single variable. A description of a branch-and-bound algorithm that found a global solution to the problem was given. Several representative applications were described as examples. The algorithm had the feature that a good feasible solution was generated at the start. Moreover, at each step of the algorithm an additional feasible solution was generated for comparison with the best solution found previously. A linear mathematical function was used to illustrate the multi-level fixed-charge problem. Then the branch-bound algorithm using subsets where the solution value is less than or equal to the lower bound for every subject was described in order to find an optimal solution to the problem. Extensions of the work described was discussed. Numerous water resources problems contain fixed charge components, and techniques such as those described in this paper should be helpful in solving them. (Kriss-Cornell)
W70-08841

COMPUTER MODEL OF CONNECTICUT RIVER POLLUTION,
United Aircraft Corp., East Hartford, Conn. Research Labs.
For primary bibliographic entry see Field 05G.
W70-08843

EVALUATION OF ALTERNATIVE SOLUTIONS FOR ACHIEVEMENT OF RIVER STANDARDS,
Quirk, Lawler and Matusky, New York.
For primary bibliographic entry see Field 05G.
W70-08846

COMPUTER AIDS IN CRAG WATER PLAN,
Clark and Groff Engineers, Salem, Oreg.
Lloyd K. Clark, Andrew M. Klein, and Carter H. Harrison.
Water and Wastes Engineering, April 1970, Vol 7, No 4, p 49-51. 2 fig, 2 tab.

Descriptors: *Computer programs, *Digital computer, Design, Planning, Water Resources, Mathematical models, *Costs, *Optimization, Water demand.
Identifiers: Portland (Ore), Vancouver (Ore).

A computerized economic analysis was used to formulate a long-range regional water plan for the Portland-Vancouver area of Oregon and Washington. Each of four rivers in the four county area could supply twice the total demand anticipated by the year 2000 but the problem was to determine which of many sources might best serve each area. All regional planning in the Portland-Vancouver area was co-ordinated by the Columbia Region Association of Governments (CRAG). A long-range plan showing how the areas municipal water needs could be met up to the year 2000 with water demands expected to average almost 300 mgd and to peak at over 700 mgd was commissioned by CRAG. The demands will be met by potential sources that were listed. Future water requirements were based on future population density. A total of 90 water-use areas and 30 sources were developed and a digital computer was employed. The objective was to serve each water-use area at the lowest average cost. The computer approach consisted of four programs to increase efficiency. One program stored population and water-demand projections, another stored data on the sources of supply. The last two programs compared alternate ways of serving the water-use atea. Five major cost items were focused on : (1) transmission line construction; (2) treatment plant construction; (3) treatment plant

operation and maintenance; (4) source of supply costs; and (5) pumps and power. Advantages and disadvantages to the computer approach were given. (Kriss-Cornell)
W70-08847

FLOOD ROUTING USING A CONVECTIVE DIFFUSION MODEL,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-08848

RESISTANCE NETWORK FOR THREE-DIMENSIONAL UNCONFINED GROUNDWATER PROBLEMS WITH EXAMPLES OF DEEP WELL DEWATERING,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 04B.
W70-08849

ECONOMIC EVALUATION OF A WATER RESOURCES DEVELOPMENT PROJECT IN A DEVELOPING NATION,
California Univ., Berkeley.
Fereidoun Mobasheri.
Water Resources Center Contribution No 126, Hydraulic Engineering Laboratory, Univ of Calif, Berkeley, July 1968. 191 p, 14 fig, 30 tab, 79 ref, 2 append.

Descriptors: *Optimization, *Linear programming, *Dynamic programming, *Cost-benefit analysis, *Social aspects, *Water resources development, *Economics, Synthesis, Multiple-purposes project, Irrigation water, Constraints.
Identifiers: Sensitivity analysis, Parameters.

An economic evaluation criterion was synthesized using the concept of benefit-cost analysis for estimating the social benefit and cost of a water resources development project in a developing country. The concept was modified so that multiple national goals and structural disequilibrium of the economy were considered. Shadow prices were used to measure economic value of production factors when there was a disequilibrium between demand and supply. The synthesized economic evaluation criterion was applied to a hypothetical multiple purpose water resources project. Using three design variables, a multi-level optimization technique was developed. The direct search technique combined with a parametric linear program and a dynamic program found the optimum combination of design variables to maximize the present net value of social benefit. The linear program found optimum allocation of annual supply of irrigation water among various crops to maximize the benefit from irrigation. The dynamic program determined optimum schedule of monthly releases from the reservoir to maximize return from power while mandatory releases, irrigation supply, and other physical constraints of the system were satisfied. A sensitivity analysis was carried out to determine optimum design changes as economic parameters were varied. (Kriss-Cornell)
W70-08854

ECONOMIC EVALUATION OF A WATER RESOURCES DEVELOPMENT PROGRAM IN A DEVELOPING NATION - CHAPTER V - MODIFICATION OF BENEFIT-COST ANALYSIS, SYNTHESIS OF A NEW CRITERION,
California Univ., Berkeley.
Fereidoun Mobasheri.
In: Water Resources Center Contribution No 126, Hydraulic Engineering Laboratory, Univ of Calif, Berkeley, p 36-77, July 1968. 1 fig, 53 ref.

Descriptors: *Cost-benefit analysis, *Water resources development, *Social aspects, Mathematical model, Equations, Synthesis.
Identifiers: Economic parameters, Shadow prices, Balance of payments.

Necessary modifications of the benefit-cost criterion for a water resources development project in a developing country were studied. The concepts of the social rate of discount and social opportunity cost of capital were introduced. An economic model was developed for measuring these two economic parameters. The problem of under-employment of unskilled agricultural labor was studied. Equations were developed for calculation of the shadow price for unskilled labor. The problem of balance of payments was introduced and equations were developed to show the effect of the development of a water resources project on the balance of payments. These modifications were then combined and an economic evaluation criterion was synthesized. (Kriss-Cornell)
W70-08855

ECONOMIC EVALUATION OF A WATER RESOURCES DEVELOPMENT PROJECT IN A DEVELOPING NATION - CHAPTER VI - OPTIMUM DESIGN OF A MULTIPLE PURPOSE WATER RESOURCES PROJECT,
California Univ., Berkeley.
Fereidoun Mobasheri.
In: Water Resources Center Contribution No 126, Hydraulic Engineering Laboratory, Univ of Calif, Berkeley p 78-123, July 1968. 9 fig, 22 tab, 18 ref.

Descriptors: *Optimization, *Linear programming, *Dynamic programming, *Mathematical models, Cost-benefit analysis, Design, Multiple purpose projects.
Identifiers: *Direct search technique, Economic parameters.

A hypothetical water resources project was developed when the criterion function synthesized for economic evaluation was used for calculation of social benefit cost of the project. A mathematical model was developed for optimum design of the project. Three economic parameters - the annual rate of gross national project growth, the degree of underemployment of unskilled labor and shadow foreign exchange rate, were parametrically varied to find how optimum design was affected by economic parameters. The optimization algorithm used to determine efficient allocation of available resources required to maximize net return was linear programming. Dynamic programming determined optimum operation of the project. Direct search for the optimum scale of development was obtained through the linear and dynamic program's subroutines. A sensitivity analysis performed determined changes in the optimum design as economic parameters were allowed to vary. Seven optimum designs were determined for seven combinations of the three economic parameters. (Kriss-Cornell)
W70-08856

AN OPERATIONAL WATERSHED MODEL STEP 1-B: REGULATION OF WATER LEVELS IN THE KISSIMMEE RIVER BASIN,
Central and Southern Florida Flood Control District, West Palm Beach.
For primary bibliographic entry see Field 04D.
W70-08858

WATERSHED MODELING BY ELECTRONIC ANALOG COMPUTER,
Utah Water Research Lab., Logan.
J. Paul Riley, and Duane G. Chadwick.
Typescript, 1968. 27 p, 10 fig, 11 ref.

Descriptors: *Analog computers, *Simulation analysis, *Hydrologic data, Watersheds (Basins), River basins, *Mathematical models, Optimization, *Water supply, Utah.
Identifiers: Sevier River, Circle Valley.

Assessment of the downstream consequences resulting from changes at specific locations in a hydrologic system to increase water supply was studied at Utah State University using electronic analog simulation. First a general introduction to simulation and a description of a hydrologic model were given. Specifically, the approach to hydrologic simulation at Utah State University was to subdivide the river basin into relatively large but meaningful components, describe their operation and fundamental processes as functions of data ordinarily available, verify, and improve definition by using more and smaller control volumes and increments. An actual hydrologic unit was then simulated. Results were obtained by the simulation of a subbasin of the Sevier River drainage in central Utah. It is referred to as Circle Valley and contains approximately 93,000 acres of mountain watershed and agricultural land. A hydrologic flow diagram where each block represents a basic hydrologic process expressed in mathematical terms was presented. A computer model synthesized these relationships and an analog flow chart for the model was shown. Mean monthly outflow values for 1962 were computed and observed. Analog simulation of other watershed areas was also attempted. (Kriss-Cornell)
W70-08860

FEDERAL EVALUATION OF RESOURCE ALLOCATION INVESTMENTS: A CASE STUDY,
Cornell Univ., Ithaca, N.Y.
Robert J. Kalter.
Water Resources and Marine Sciences Center and Department of Agricultural Economics, Cornell University, Ithaca, New York, February 1970. Tech Report No 24, AE Res 313. 89 p, 20 tab, 1 append.

Descriptors: *Resource allocation, *Investment, *Optimization, *Research and development, *Economic efficiency, Project planning, *Evaluation, West Virginia.
Identifiers: Empirical testing, Task force, Data problems, Stonewall Jackson Reservoir.

The report presented the results of a research effort whose principal objective was to empirically test the procedures recommended for evaluation of public resource investments by a Special Task Force of the Water Resources Council. The main recommendations of that task force included a broadening of the traditional framework of project analysis beyond economic efficiency to include additional criteria of regional development, environmental enhancement, and well-being of people. Since the methodology outlined for implementation by the task force was not often fully developed or was, at times, inconsistent with theoretical principles, four criteria for project evaluation were presented. In addition, alternatives in plan formulation and a system of accounts necessary to display evaluation results were developed. Each major section included subsections on conceptual foundation for evaluation of the particular objective, methodology necessary and appropriate for such evaluation, data needs and possible data sources for empirical implementation, consideration of actual data sources and a summary of specific data problems, empirical testing of the methods proposed with realistic hypothetical data and appropriate display of findings. Tests were conducted on the proposed project of the U.S. Army Corps of Engineers on the West Fork River, West Virginia known as the Stonewall Jackson Reservoir. The project involved a concrete dam and reservoir at Brownsville, WV which was multipurpose in nature. (Kriss-Cornell)
W70-08861

FACILITIES DESIGN - A PROBLEM OF SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, N.Y.; and Birmingham Univ. (England).
Bryon W. Saunders.
Typescript for International Conference on Production Research, University of Birmingham, Birmingham, England, April 6-10, 1970. 12 p, 9 ref.

Descriptors: *Optimization, *Systems analysis, *Resources, *Waste treatment, *Pollution abatement, *Population, *Decision making, *Facilities, *Design, Water costs.

The problem of how to measure the internal activities of the manufacturing system which must be correlated with the externalities in the larger total ecosystem in order to achieve the necessary optimization was presented. Examples of waste and pollution were given to indicate the magnitude of the problem. The two most directly related factors causing the problem were suggested to be overpopulation and inadequate and inappropriate decision criteria in the form of product cost minimization. Overpopulation, within certain areas and regions, creates facilities design conditions and increasing rates of use of basic resources. It has many interesting facets that need research as 'systems' problems in such areas as clean air, water, oxygen, land, recreation, etc. It was postulated that the population problem therefore is the underlying cause of all others. Secondly, it was suggested that industry is a significant contributor to the problems because of its decision criteria. An example was given of the pollution of a Norwegion Valley. Inadequate systems designs have developed and therefore better criteria, more efficient measures of effectiveness, and development of studies that will replace empiricism and intuition with known measurements that will allow optimization of the total ecosystem leading to an improved 'quality of life' for all must be established. (Kriss-Cornell)
W70-08862

MATHEMATICAL MODELING IN HYDROLOGY,
International Association of Scientific Hydrology, Gentbrugge (Belgium).
D. R. Dawdy, and G. P. Kalinin.
Bulletin of the International Association of Scientific Hydrology, Vol XV, No 1, March 1970, p 145-154. 10 p, 24 ref.

Descriptors: *Mathematical models, *Hydrology, *Computers, *Data processing, Simulation analysis, *Parametric hydrology, *Stochasic processes, Systems analysis, *Water resources development, Design.

The report was prepared on behalf of the committee on Mathematical Models in Hydrology of IASH. The successful development of branches of hydrology such as hydrologic forecasting, hydrological calculations, theory of water resources control and mathematical processing of observation data by use of application of physical and mathematical methods and use of computers was discussed. Topics included were: (a) scientific data processing; (b) solution of the equations of mathematical physics; (c) semi-empirical hydrologic simulation; (d) theory and practice of water resources control; and (e) the shortcomings of present methods to the development of theoretical and applied hydrology and methods of runoff control. The three working groups of the committee, which stressed applications of particular mathematical tools rather than the discipline in which a particular problem occurred, were then presented. They were (1) Parametic Hydrology concerning deterministic models; (2) Stochastic hydrology concerned with probabalistic models such as chain simulation models or gueueing models; and (3) Water Resources Systems concerned with decision theory in planning and design and applications of operations research to the water resources field. A general picture of what has been done and what yet remains to be done in the area of mathematical models in hydrology was given. (Kriss-Cornell)
W70-08863

SURFACE IRRIGATION USING KINEMATIC-WAVE METHOD,
Utah Water Research Lab., Logan.
Cheng-lung Chen.
ASCE Proceedings, Journal of the Irrigation and Drainage Division, Vol 96, No IR1, Paper 7134, p 39-46, March 1970. 2 fig, 8 ref.

Descriptors: *Mathematical models, *Surface-groundwater relationships, *Irrigation design, Drainage, Infiltration, Overland flow, Soil water movement, Groundwater movement, Irrigation practices, Irrigation ditches.
Identifiers: *Kinematic wave models.

In the kinematic-wave method, one-dimensional unsteady mathematical models for flow in surface irrigation consist of the equation of continuity for the surface flow, the simplified equation of motion, a uniform-flow formula for the surface flow, the simplified flow equation for the subsurface flow, the infiltration equation or an empirical formula, and appropriately prescribed initial and boundary conditions. The kinematic-wave method alone is valid only for supercritical flow. The complete model may be solved to yield a general solution that depends on the solution form of the cumulative depth of the subsurface flow at the head ditch. A particular solution for a constant infiltration rate reduced from the general solution is shown to be compatible with that obtained from the modified Lewis-Milne equation. (Knapp-USGS)
W70-08948

PRIME-ALBERTA'S BLUEPRINT FOR WATER DEVELOPMENT,
Department of Agriculture, Edmonton (Alberta). Water Resources Div.
For primary bibliographic entry see Field 06B.
W70-08994

ELKHART LAKE, WISCONSIN COMPREHENSIVE PLAN.
Wisconsin State Dept. of Local Affairs and Development, Madison. Bureau of Local and Regional Planning.

Available from the Clearinghouse as PB-189 006, $3.00 in paper copy, $0.65 in microfiche. Final report, ELVPC-70-3, Jan 1970, 188 p.

Descriptors: *Wisconsin, *City planning, Recreation, Water pollution, Land use, *Planning, Maps, Economics.
Identifiers: Elkhart Lake (Wisconsin).

Elkhart Lake is a small recreation and tourist-oriented cast central Wisconsin community. Although recreation activities have shown some growth during the summer months, very little other industry exists in the village and growth has been moderate for the past several decades. It is anticipated that this trend will continue. A vital concern of local officials and citizens is the protection and preservation of Elkhart Lake, the village's primary recreational and scenic resource. Although little progress has been made to date, village officials and local interest groups are attempting to halt pollution of the lake through provision of sanitary sewer facilities to lake-shore properties, and restrictions on use of the lake for recreational activities.
W70-09004

6B. Evaluation Process

CONSTRUCTION PLANNING OF THE UNDERGROUND POWERPLANT,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
F. J. Patterson, and I. C. Dirom.
Engineering Journal - Canada, Vol 52, No. 10, p. 125-130, Oct 1969. 6 p, 3 fig, 4 tab.

Descriptors: *Construction, *Planning, Underground structures, Tunnel construction, *Underground powerplants, Powerplants, Contracts, Foreign construction, Hydroelectric plants, Coordination, Excavation, Sequence, Concrete placing, Scheduling.
Identifiers: Portage Mountain Powerplant, Canada; Canada, Construction methods, Equipment installation.

Construction planning was a vital factor in ensuring generation of power on schedule at the Portage Mountain Development in Canada. Detailed planning of the underground powerplant, selection of construction contracts, and assumed critical and near critical construction sequences are described. Four tabulations are included showing main construction contracts, some of the more important interlocking dates between the main powerplant contract and other associated contracts, and planned as compared to actual excavation methods and excavation and concrete placement rates. (USBR)
W70-08687

WATER IN THE DESERTS,
Office of Water For Peace, Washington, D.C.
Dean F. Peterson.
Paper International Conference on Arid Lands in Changing World, Univ Ariz, Tucson, June, 1969. 28 p, 2 fig, 2 tab, 34 ref.

Descriptors: *Deserts, *Water supply, *Ecology, Rainfall, Water, Dams, Wells, Water resources, Streams, Springs, Aquifers, Groundwater, Water quality, Grazing, Agriculture, Irrigation, Economics, Canals, Pumping, Hydroelectric power, Waterlogged land, Salinity, Floods, Technology, Arid lands, Bibliographies.
Identifiers: Orographic precipitation.

Life in the desert, as elsewhere, needs water for existence. By definition, deserts are dry, but life does survive, and man has used desert areas for his purposes for millenia. Man's capability to use the desert is changed as he gains new technology and new sources of energy that make new water supplies available to him, but his impact on the ecology of the desert also is different. The sources of water in the desert and how these sources are being used are reviewed. Large, complex irrigation systems existed 5000 yr ago, but new technological capabilities exists, including hydroelectricity, large dams, large and efficient earth moving equipment, and improved agricultural practices. Using modern technology, much can be done to permit further use of the attractive desert environment; great care and forethought are required, lest use becomes exploitation and the ecological consequences outweigh the benefits. (USBR)
W70-08689

THE BRANDYWINE PLAN,
Pennsylvania Univ., Philadelphia.
John C Keene, and Ann Louise Strong.
Journal of the American Institute of Planners, Vol 36, No 1, p 50-58, January 1970. 2 fig, 1 photo.

Descriptors: *Water resources, Eminent domain, Easements, Regulation, Data Collections, Communication, Political aspects, Legal aspects, Economics, Value.
Identifiers: *Brandywine Plan, Urban development, Local institutions, Personality patterns, Objectives, Inducements, Restrictions.

The Brandywine Plan was concerned with a program for protecting water resources and guiding urban development as it would occur over the next fifty years in a rural watershed thirty miles west of Philadelphia. The authors describe the development of the plan and the opposition and rejection of it via the political system, local institutions, the legal system, economic aspects, the personality and value patterns of the watershed residents. In conclusion, the authors recommend that for a proposal such as this to be accepted the following factors must exist: (1) There must be sufficient time available to work out a program that is endorsed by a substantial number of residents. (2) Proponents must be willing and able to proceed with experiments on a small scale so that some of the novelty of the program can be dispelled. (3) Objectives of the program must be modest so as to allow more flexibility in working out a successful compromise of conflicting interests. (4) Positive inducements must be available to balance restrictions perceived by residents. (Loeb-Rutgers)
W70-08690

ENGINEERING ECONOMY IN THE UNITED STATES IN RETROSPECT--AN ANALYSIS,
Stevens Inst. of Tech., Hoboken, N. J.
A. Lesser.
Engineering Economist Vol 14, No 2, p 109-115, Winter 1969, 7 p, 18 ref.

Descriptors: *Economic analysis, *Engineering, *Economics, *Resource development, *Cost-benefit analysis, Mathematical studies, Risk, Marginal utility, Computers, Input-output analysis, Budgeting, Investment, Financing, Bonds, Mathematical studies.
Identifiers: *Engineering economy, *Actuariel mathematics, Business cycle, Welfare economics, Capital rationing.

This article traces and analyzes the evolution of the main streams of thought of engineering economy in the United States. Engineering economy is defined as a guide for the economic selection among technically feasible alternatives for the purpose of a rational allocation of scarce resources. The three separate (but sometimes tangential) streams of thought on this topic are classical engineering economy, benefit-cost analysis and economic analysis. The study of these seems to indicate that resource development should be closely related to engineering economy in the United States. This conclusion is reached after considering both the three main streams of development and such considerations as risk, uncertainty, utility theory, and mathematical or computer models. Due to the importance of water resources in natural resource development, water researchers will find this article of interest. (Murphy-Rutgers)
W70-08691

CRITERIA FOR PUBLIC INVESTMENT: A COMMENT.
Johns Hopkins Univ., Baltimore, Md.

Journal of Political Economy Vol 78, No 1, p 175-177, Jan/Feb. 1970.

Descriptors: *Discount rate, *Economic evaluation, *Cost-benefit analysis government, Time, Income, Economic efficiency, Social aspects, Decision-making, Mathematical studies.
Identifiers: *Private investment, *Government investment, *Social cost, Opportunity costs, Rate of time preference.

The author is concerned with the recent interest shown in using the rate of return on private investments for discounting purposes when evaluating the time streams of benefits and costs generated by public investments. The proper discount rate to use when evaluating water resource investments has created controversy and this clarification of issues should prove valuable to the water resource planner. The paper shows that: (1) The social opportunity cost of transferring funds from the private to the public sector is independent of the source of such fund, i. e. private consumption or private investment. (2) The proper investment criterion for public investment is that the present discounted value, using the rate of return on private investment as the discount factor, of benefits minus costs be non-negative. (Murphy-Rutgers)
W70-08695

ANALOGUE COMPUTING FOR PROJECT EVALUATION,
Imperial Chemical Industries Ltd., Ill.
David W. Gillings.
The Engineering Economist Vol 11, No 2, p 1-11, Winter 1966 11 p, 1 tab, 4 fig.

Descriptors: *Economic evaluation, *Project planning, *Computers, Economics, Profits, Digital computers, Analog computers, Income, Competition, Prices, Interest rate, Costs, Demand, Investment.
Identifiers: *Project evaluation, *Rate of return, *Cash flow.

Methods of profitability estimation based on discounted cash flow principles are now well established and widely applied. If the full benefit of using comprehensive methods is to be derived, there must, however, be extensive calculation. These methods should explore all of the alternative technical proposals for meeting the specified aim of the project and all the alternative conditions of the market in which the project will have to be operated. This can easily be accomplished through the use of computers. The author describes the application of computers to these computations and gives an example of an industrial problem. Some of the advantages are pointed out and other possible lines of application described. The importance of project evaluation and economic forecasting in the water resource area make this article valuable (Murphy-Rutgers)
W70-08696

PLANNING IN RURAL AREAS,
Cornell Univ., Ithaca, N.Y.
Alan J. Hahn.
Journal of the American Institute of Planners, Vol 36, No 1, p 44-49, January 1970.

Descriptors: *Planning, *Rural areas, Governments, Costs, Demand, Cities, Zoning, Leadership, Natural resources.
Identifiers: Economic development, Urban poverty, Rural opposition, Rural values, Industrial development, Rural activity patterns.

Planning in rural areas is becoming increasingly important. First, there is the rising national concern with economic development of depressed rural areas. Second, there is recognition that urban poverty and related problems are, at least in part, a consequence of conditions in rural areas. Finally, the outward movement of dissatisfied urbanities is extending beyond areas that can accurately be called suburban, and into countryside and jurisdictions that are rural. These trends result in demands on the planning profession for application of its methods and expertise to rural communities. Nevertheless, planning in rural areas is often unsuccessful. A major obstacle is the recalcitrance of rural citizens, leaders, and government. Their acceptance of planning as an appropriate local public activity is absent, or half-hearted at best. The purpose of this paper is to explore reasons for this and suggest some solutions. It draws heavily on the experience with a regional development educational project in the Central New York Region, a five-county area around Syracuse, New York. This article may prove helpful to the planner involved with water resources development in rural areas. (Loeb-Rutgers)
W70-08698

NATURAL RESOURCES AND RESEARCH ADMINISTRATION,
Economic Research Service, Washington, D.C.
George A. Pavelis.
Journal of Soil and Water Conservation, Vol 24, No 4, p 127-131, July-August 1969. 16 ref.

Descriptors: *Natural resources, Management, Planning, Environment, Decision making, Economics, Communication.
Identifiers: *Research administration, Research, Resource management, Objectives, Cooperation.

Natural resource professionals often ask how public research organizations can focus their talents and resources more precisely on the realities of solving practical management problems. They question why decades of continuing and publicly supported research in all areas of agricultural science at state universities and by the U S Department of Agriculture have not produced a body of knowledge and experience specific and versatile enough to solve most problems encountered. These questions encompass the larger matter of how research and planning are related elements in determining how our natural environment should be managed. The author concludes that important avenues of improvement lie in clearly defining the objectives sought in making management decisions or in setting up research studies, in developing analytical information tailored to these objectives, and in developing responsive research organizations. The catalyst for progress in all three directions are free communications and cooperation among conservation minded individuals, planning technicians, their research associates in universities and government agencies, and the research organizations themselves. (Loeb-Rutgers)
W70-08699

A METHOD TO ANALYZE THE EFFECTS OF FLUCTUATING RESERVOIR WATER LEVELS ON SHORELINE RECREATION USE,
Waterloo Univ. (Ontario).
Reiner Jaakson.
Water Resources Research Vol. 6, No. 2, p. 421-529.

Descriptors: *Reservoirs, *Recreation, *Floods, *Water level, Optimization, Economic justification, River basins, Planning, Dams, Water supply, Data collections, Mapping, Beaches, Beach erosion, Computers, Maximization.
Identifiers: Buffalo Pound Lake, Lake Diefenbaker, Backshore.

This paper presents a method whereby the optimum water level for a reservoir can be identified based on an analysis of recreation potential of the shoreline at different lake levels. The author feels that the recreation segment of many multipurpose projects forms one of the more active basic economic catalysts for regional growth and that this justifies the maintenance of constant or near constant levels during the recreation season. The three stages involved in the analysis were field data collection, mapping and quantification. The methodology allows economic comparisons of the value of maintaining constant lake levels with the value of maintaining flood storage levels. (Murphy-Rutgers)
W70-08700

THE CONVENTIONAL WISDOM IN WATER PHILOSOPHY,
University of Southern California, Los Angeles; and Arizona State Univ., Tempe.
John M. Bruner, and Martin T. Farris.
Water Resources Bulletin, Vol 5, No 4, p 43-48, December 1969. 5 ref.

Descriptors: *Water policy, Investment, Water utilization, Water management, Water supply, Demand, Prices, Water allocation, Economics.
Identifiers: *Conventional wisdom, *Water philosophy, Water projects, Water images.

The National Academy of Sciences recently warned against the commitment of substantial investment funds for water projects without careful consideration of scientific, engineering, economic, and social perspectives which, in their estimation, should qualify major water management decisions. There is little doubt that investments are being made and contracted for that do not auger well for economic development. The objective of this paper is to attempt a partial explanation of actual and potential inefficiencies in water management by describing and lending empirical support to the existence of a barrier to effective water management. This barrier can be termed 'conventional wisdom in water philosophy.' The contention here is that for a variety of reasons, a conventional wisdom regarding water has evolved, and that it has crystalized into a widely held philosophy toward water that has exceedingly important policy implications. In addition, it appears that the principal effect of this philosophy is to limit the range of choice in water policy proposals, and to introduce a predisposition toward certain types of proposals to the exclusion of others. (Loeb-Rutgers)
W70-08701

NPUT-OUTPUT TECHNIQUES FOR URBAN OVERNMENT DECISIONS,
alifornia Univ., Los Angeles.
'erner Z. Hirsh.
merican Economic Review Vol. LVIII, No 2, p 52-170, May 1968.

escriptors: *Regional analysis, *Input-output nalysis, Local government, Planning economic valuation, Forecasting, Model studies, Sewerage, ecreation, Water supply, Demand, Taxes, Cost-enefit analysis, Economies of scale.
entifiers: *St. Louis, Missouri, *Production func-on, Labor, Industrial development, Fiscal health.

his paper attempts a consideration of local urban overnments and presents an urban public services rojection model and a regional planning model to valuate alternative plans in terms of their net fiscal ealth results. Input-output techniques are em-oyed in each model. This article is of interest to ie water researcher not only for its discussion of ater and sewerage services, but also for the ieoretical insight it provides in the use of input-utput techniques for regional planning purposes. he first model treats government as a productive gent and assumes the existence of a linear omogenious production function. The local overnment services are disaggregated, according uniformity of demand into five sectors, one of hich is the water and sewerage sector. Using St. ouis, Missouri as a case study, control totals for ach sector were estimated, inputs allocated to the pplying industrial sector and output allocated to ie service recipients. Another model is then resented which seeks to explain the implications f exogenous and local private sector forces for scal health of the government. In the first stage ie impact of changes in final demand on output nd income is estimated with the second stage esti-ating the revenue and expenditure implications. Murphy-Rutgers)
V70-08704

/OTING AND SOCIAL CHOICE,
'rinceton Univ., N.J.
)onald E. Campbell.
'he American Economist, Vol 14, No 1, p 35-44, Spring 1970. 3 ref.

)escriptors: *Welfare, Preferences, Social values.
dentifiers: *Voting, *Social choice, Indifference, Arrow's conditions, Binary relation, Transitivity so-ial welfare function, Individual values, Alterna-ives, Social orderings, Democratic requirements, Nondictatorship condition, Neutrality, Pareto op-imality.

This paper examines the problem of social choice along the lines developed by Arrow. All configura-ions, or states of the economy, that can be com-pared in terms of preference and indifference by in-dividuals are socially ordered. Then the question of whether or not to undertake a particular public project can be settled by using the social ordering to compare, in terms of social preference and indif-ference, the configurations that would accompany the two options. Ideally a society could use the so-cial ordering to choose the best of all feasible con-figurations. Arrow's technique of requiring the so-cial ordering to depend upon the indifference maps of the individual economic units and to satisfy cer-tain conditions claimed to be generally accepted are used. This paper derives the existence of a class of social orderings, each member of which satisfies two fundamental democratic requirements as well as Arrow's conditions 1, 2, 4, and 5 and a weak ver-sion of his Condition 3. Only orderings in a slightly more general class satisfy all of the seven condi-tions. The use of social ordering criteria is made implicitly in the water area when deciding whether or not to undertake a particular public project. (Loeb-Rutgers)
W70-08710

THE CONSISTENCY AND EFFICIENCY OF GENERALIZED LEAST SQUARES IN SIMULTANEOUS EQUATION SYSTEM WITH AUTOCORRELATED ERRORS,
Bristol Univ. (England).
M. R. Wickens.
Econometrica, Vol 37, No 4, p 651-659, October 1969. 12 ref, 1 append.

Descriptors: Statistical methods, Economics.
Identifiers: *Consistency, *Efficiency, *Generalized least squares, *Simultaneous equations, *Autocorrelated errors, Autoregressive process, Two stage least squares, Three stage least squares, Estimators, Madansky type estimator.

Several existing single equation estimators, designed for the case where the structural disturbances are generated by a first order autoregressive process, are generalized for situations where the autoregressive process is of higher order than one. These generalized estimators are shown to be consistent, both when the parameters of the generating process are known and unknown, and their asymptotic relative efficiencies are compared. Three full information estimators are also examined. They are shown to be consistent with asymptotic efficiencies ranked like their single equation counterparts. Among the results derived are the consistency of 2SLS and 3SLS in this situation and the overall relative efficiencies of the 'Theil-Fisher' type estimators compared with the 2SLS-3SLS and 'Madansky' type estimators. This article is of general interest to water research projects employing simultaneous equation models of estimation. (Author)
W70-08711

BEHAVIOR TOWARDS RISK WITH MANY COMMODITIES,
Yale Univ., New Haven, Conn.
Joseph E. Stiglitz.
Econometrica, Vol 37, No 4, p 660-667, October 1969. 1 fig.

Descriptors: *Behavior, *Risks, Prices, Income, Economics, Social values.
Identifiers: *Commodities, *Indifference map, Consumer behavior, Risk neutral, Price ratios, Utility, Consumer behavior, Ordinal utility, Cardinal utility, Quadratic utility function, Risk aversion, Engel curves, Time preference, Income-consumption curves, Bernoulli utility function.

In the recent development of the theory of consumer bahavior, there have been two seemingly disjoint strands: the ordinal utility theory of consumer's choice with many commodities and the Von Neumann-Morgenstern cardinal utility theory of consumer behavior under uncertainty where individuals maximize their expected utility. It has not been sufficiently realized how intimately related these two theories are. The purpose of this paper is to show what restrictions on the indifference map (e.g., on the income-consumption curves) are implied by alternative assumptions about consumer behavior under uncertainty and, conversely, what restrictions on consumer behavior under uncertainty are implied by alternative assumptions about the indifference map. The importance of the results obtained in this paper is threefold: first, they suggest further reasons for avoiding particular parameterizations of attitudes towards risk. Second, they provide a way of ascertaining some information about an individual's attitudes towards risks by looking at Engel curves. Third, if the different commodities are interpreted as consumption in different periods, then the techniques developed here can be used to infer restrictions on consumer time preference from certain assumptions about saving behavior under uncertainty and vice-versa. This would prove useful in the water area when investigating demands for water supplies under conditions of risk and uncertainty. (Loeb-Rutgers)
W70-08712

ECONOMICS AND A NEW SOCIAL SCIENCE THRESHOLD,
Resources for the Future, Inc., Washington, D.C.
Edgar S. Dunn, Jr.
Southern Economic Journal, Vol 36, No 4, p 353-364, April 1970. 9 ref.

Descriptors: Economies, Resources, Diffusion.
Identifiers: *Social science, Developmental problems, Metaphors, Growth, Information, Stage theory, Social system learning, Evolution, Social learning.

The author contends that the major social problems of our era are developmental problems and these are exacerbated by the inbalance in our understanding and practice of the process of social learning as it applies to deterministic physical systems in contrast with nondeterministic creative social systems. This condition is further exacerbated by our adherence to several limited, if not unrealistic, metaphors of social change. A science paradigm is emerging that sees the classical experimental method and the classical science metaphor as demonstrating limited applicability to the more general task of problem solving associated with social system development. The emerging social learning metaphor is trying to make manifest a more general and inclusive process of evolutionary experimentation that is more nearly identifiable with the root process of social system problem solving. The author contends that if economies is to continue making contributions to the domain of economic and social development, it must apply itself to the task of improving our understanding and practice of the process of social system learning. This general reasoning could be extended to the economics of the water area as it relates to the social system. (Loeb-Rutgers)
W70-08713

AN ECONOMICALLY MEANINGFUL AND WORKABLE SYSTEM FOR CALCULATING FLOOD INSURANCE RATES,
Chicago Univ., Ill.
Howard Kunreuther, and John Sheaffer.
Water Resources Research Vol 6, No 2, p 659-667, April 1970.

Descriptors: *Flood plain insurance, *Risks, *Floods damage, Cost, River, Economic efficiency, Flood frequency, River basin, Management, Government supports, Social aspects, Statistics, Flood-proofing.
Identifiers: *Flood Insurance Act, *Insurance rates.

This paper focuses attention on the operating issues related to the establishment of flood insurance premiums for individual residential structures. The proposition presented is that rates on new as well as on existing houses can be determined quickly and economically on the basis of individual characteristics and conditions rather than on an average rate for a widely varying zone. An individual rating basis would not require a change in the dual system of premiums, acturial rates for new structures and subsidized rates for existing structures, provided for in the Flood Insurance Act of 1968. The customizing of individual rates will eliminate the adverse selection feature of the present method where damage is averaged over a region and may also expedite the extension of flood insurance coverage. (Murphy-Rutgers)
W70-08717

MULTIDIMENSIONAL RISK AND THE MODIGLIANI-MILLER HYPOTHESIS,
Robert W. Resek.
The Journal of Finance Vol. XXV No 1, p 47-51, March 1970.

Descriptors: *Capital, *Costs, Debt, Risk, Economic evaluation, Optimization, Interest rate, Investment, Forecasting, Efficiency, Taxes.
Identifiers: *Modigliani-Miller Hypothesis, *Dept equity ratio, *Leverage, Bonds, Stocks, Default.

What is known as the Modifliani-Miller hypothesis states that the average cost of capital to any firm is completely independent of its capital structure. This has obvious implications for firms in the water

resource area with large capital investment and a long paypback period. The paper considers this proposition and shows that, under the general circumstances hypothesized by its authors the proposition in not true. They consider the different ways of raising capital and, because of the possibility of default on bonds in a world with taxes find the cost of capital to a firm likely to be affected by its financial structure. The conclusions of this paper point out the necessity for the water resource utility to consider varying its financial structure to minimize capital costs. (Murphy-Rutgers)
W70-08718

THERMAL POLLUTION: THE EFFECT OF THE PROBLEM,
La Salle Coll., Philadelphia, Pa.
For primary bibliographic entry see Field 05C.
W70-08719

ENVIRONMENTAL PROBLEMS,
Rutgers - The State Univ., New Brunswick, N.J.
Betty Ray Wilson.
Philadelphia, J. B. Lippincott Co. 1968, 183 p.

Descriptors: *Thermal pollution, *Water quality, *Environmental effects, Air pollution, Data processing, Pesticides, Desalination, Government, Financing, Fish, Management, Herbicides, Costs, Insecticides, Rivers, Population, Radiation, Waste disposal, Wells, Transportation, Reservoir, D.D.T., Urban renewal, Model studies.
Identifiers: Environmental synergisms, Housing.

This book is the result of a conference at Rutgers University on April 24 to 26, 1967 and concerned with encouraging college faculties to stimulate students to enter into careers in the environmental area. The book represents a selection of problems currently important and representative of the entire field of environmental quality control. It discusses the nature of environmental health sciences, the dimensions, issues and determinants of urban development, the overall behavior of man in his society and the problem and effects of pesticides in the environment. Of particular interest for the water researcher are the chapters dealing with the economic, biological and physical problems involved in thermal pollution and its effect on the environment. The book concludes with two chapters on the problem of environmental synergisms. (Murphy-Rutgers)
W70-08720

WATER FOR THE YEAR 2000,
Lawrence Burgess.
American Water Works Association Journal, Vol 62, April 1970, p 211-214.

Descriptors: *Water resources development, *Natural resources, *Non-structural alternatives, *Planning, Water demand, Water supply, Legislation, Cities, Area development, Federal government, Multiple-purpose projects, Project purposes, Water policy, Politcal aspects, Regulation, Water quality control, Pollution abatement, Water pollution, Water Quality Act, Water Resources Planning Act, Costs, Environmental effects, Ecology, Population, Aesthetics.

Water resources were first developed in the United States by private interests seeking to promote small-scale enterprises. Later, the federal government began large-scale water resource development in such fields as flood control, reservoirs, channel improvement, irrigation, transportation and water power. Unfortunately, most such projects were carried out to alleviate particular water problems, and comprehensive planning for water resource development was frequently missing. The river basin approach did not effectively integrate agriculture, mining, forests and urban areas in the development. In planning for future needs, more comprehensive planning is imperative. Consideration must be given not only to meeting the greater demand for water but to relating water resource development to standards of environmental quality. Consideration must be given such aspects of the environment as aesthetics, pollution abatement, and the prevention of overcrowding. Technology must serve, not dictate future development. (Hubener-Florida)
W70-08798

ON THE CHOICE OF RISK LEVELS IN MANAGERIAL DECISION-MAKING,
Kent State Univ., Ohio.
B. L. Myers, and A. J. Melcher.
Management Science: Applic, Vol 16, No 6, p B-31-B-39, Oct 1969. 5 tab, 15 ref.

Descriptors: Risks, Management, Decision making, Planning, Costs, Variables.
Identifiers: Alpha and beta values, Errors.

The purpose of the study was to develop a set of factors which would enable on to answer questions regarding specific alpha and beta values, whether they should be large or small errors, and to what kinds of decisions are the errors related. The set of factors found useful in thinking through the difficulties encountered were: (1) number of alternatives, (2) planning horizon, (3) past success of decision-maker, and (4) cost-revenue consequences of an action. The difference between the expected costs of proposed projects and the expected costs associated with reducing error levels was highlighted since the difference has led to some confusion in establishing error levels. It was hypothesized that several variables may be used to generate the error levels. (Kriss-Cornell)
W70-08842

RATIONAL URBAN PLANNING: PROBLEMS AND PROSPECTS,
Darwin G. Stuart.
Urban Affairs Quarterly, Vol 5, No 2, p 151-182, Dec 1969. 1 fig, 32 ref.

Descriptors: *Planning, *Mathematical models, Budgeting, *Constraints, Economics, Resources, Programs, *Analytical techniques, *Decision-making.
Identifiers: Rational Urban Planning, Goals, Urban problems, Community objectives.

The efficiency of comprehensive rational planning as a strategy for dealing with complex urban problems was examined. Implications of six basic steps involved in this rational process, in terms of the practical problems and tasks involved, were discussed. First, community objectives were identified. Then existing government programs and policies were cited. The basic analytic framework and mathematical models were developed for inputs and outputs. Relative goal achievement was stratified according to effected economic activities, social groups and spatial locations. Weights were assigned to community objectives and finally preferred alternatives were identifiedsubject to budget constraints. Many difficulties and weaknesses were identified because ofthe enormous informational requirements of the method. As an alternative the Lindbom Strategy of 'successive limited comparison' or 'disjointed incrementalism' was presented as a behavioral method of governmental, policy-making. Objectives and policies are chosen at the same time. Finally, a third general model which represents a middle-range compromise between the other two was proposed as a program-policy trade-off model. Using the Model Cities Program as an example, it was recommended as a workable alternative to comprehensive rational planning. Has 31 references. (Kriss-Cornell)
W70-08844

HYDROLOGIC ENGINEERING TECHNIQUES FOR REGIONAL WATER RESOURCES PLANNING,
Corps of Engineers, Davis, Calif. Hydrologic Engineering Center.
Augustine J. Fredrich, and Edward F. Hawkins.
Water Resources Bulletin, Vol 6, No 2, p 249-260, March-April 1970. 4 fig, 12 ref.

Descriptors: *Hydrology, *Engineering, *Regional analysis, *Planning, *Computers, Reservoirs, Water resources development, Hydrographs, California, Northeast USA, Missouri, River Basin.

The Hydrologic Engineering Center has been involved in aiding in the development of some hydrologic techniques for use in regional planning studies. Most of the new techniques emphasize computational procedures developed specifically for use with electronic computers. Many studies have been recently completed or are in progress. Three such studies were dealt with in detail. First, the initial effort in regional analysis was the formulation of procedures for determining standard flood estimates for southern California coastal streams using generalized criteria. Techniques developed were readily adaptable to the computer and determined representative unit hydrographs, losses and standard project precipitation for any location in the study area. As a result of the recent drought in the Northeastern United States, a study was made to evaluate present and future water supply reservoirs in that region. The study consisted of computerized studies of the hypothetical operation of a large number of reservoirs as a system. They were on many different streams throughout the region and had varying constraints. A third example given was the development of a computer-aided screening procedure for use in evaluating several hundred potential reservoir sites for the Missouri River Basin Comprehensive Framework study. Physical, hydrologic and climatologic data in estimating reservoir storage requirements throughout the basin were used. From this study there seem to be many potential areas of application for new hydrologic engineering techniques for use in regional water resources planning. (Kriss-Cornell)
W70-08845

EVALUATION OF ALTERNATIVE SOLUTIONS FOR ACHIEVEMENT OF RIVER STANDARDS,
Quirk, Lawler and Matusky, New York.
For primary bibliographic entry see Field 05G.
W70-08846

ECONOMIC EVALUATION OF A WATER RESOURCES DEVELOPMENT PROJECT IN A DEVELOPING NATION,
California Univ., Berkeley.
For primary bibliographic entry see Field 06A.
W70-08854

ECONOMIC EVALUATION OF A WATER RESOURCES DEVELOPMENT PROGRAM IN A DEVELOPING NATION - CHAPTER V - MODIFICATION OF BENEFIT-COST ANALYSIS, SYNTHESIS OF A NEW CRITERION,
California Univ., Berkeley.
For primary bibliographic entry see Field 06A.
W70-08855

ECONOMIC EVALUATION OF A WATER RESOURCES DEVELOPMENT PROJECT IN A DEVELOPING NATION - CHAPTER VI - OPTIMUM DESIGN OF A MULTIPLE PURPOSE WATER RESOURCES PROJECT,
California Univ., Berkeley.
For primary bibliographic entry see Field 06A.
W70-08856

UTILITY MEASUREMENT IN PUBLIC HEALTH DECISION MAKING,
California Univ., Berkeley.
David H. Stimson.
Management Science: Applic, Vol 16, No 2, Oct 1969, p B-17-B-30. 14 p, 1 tab, 3 fig, 44 ref.

Descriptors: *Decision making, *Resource allocation, *Model studies.
Identifiers: Tasks, Objectives, Maximizing effectiveness.

The Churchman-Ackoff approximate measure of value method was used to measure the utilities of objectives of decision makers in a large public health agency. The utilities thus obtained formed part of a model of a resource allocation problem faced by the agency in its role as allocator of a federal grant. A comparison of the normative solution derived from the model with the solution already decided upon by the agency tended to support the hypothesis that the members of the agency chose among alternatives as if they were maximizing expected utility. The first task given to the subjects used in the experiment was the assigning of values to seven objects used in the model. The second task was to compare the assignment of numerical values to objectives implicit in the choices of the first task with the ratings of the objectives in the second task in order to get a unique set of values for the objectives. The third task was designed to obtain the efficiency of each alternative to achieve each objective. The criterion used for the selection of alternatives in the model was the maximization of effectiveness. (Kriss-Cornell)
W70-08859

FACILITIES DESIGN - A PROBLEM OF SYSTEMS ANALYSIS,
Cornell Univ., Ithaca, N.Y.; and Birmingham Univ. (England).
For primary bibliographic entry see Field 06A.
W70-08862

PRIME-ALBERTA'S BLUEPRINT FOR WATER DEVELOPMENT,
Department of Agriculture, Edmonton (Alberta). Water Resources Div.
Reginald E. Bailey.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 227-234, 1969. 3 fig.

Descriptors: *Water resources development, *Inter-basin transfers, Water conveyance, Water transfer, Water management (Applied), Planning, Irrigation water, Domestic water, Municipal water, Industrial water, Water supply.
Identifiers: *Alberta (Canada).

The program of the Alberta Water Resources Division to guide the development of the province's water resources is described. The greatest requirements for water are in southern Alberta where irrigation, industrial, domestic and municipal demands are well established. The largest rivers, however, are in the north carrying their water to the Arctic Ocean away from the centers of population. About 89 percent of the total water flowing through Alberta is carried by these northward flowing rivers. The remaining 11 percent must serve 85 percent of the population. The solution to this problem of distribution is the diversion of northern waters southward where they are more urgently needed. Basin by basin, a transfer of northern waters to the south is planned. In many cases short gravity diversions are possible. In all cases only surplus water from storage reservoirs will be diverted, thus protecting downstream users dependent upon present supplies. (See also W70-08597)
W70-08994

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

NEW JERSEY WATER SUPPLY COMM'N V STATE WATER POLICY COMM'N (WATER RATES FOR SURFACE AND SUBSURFACE WATER SUPPLIES).

129 N J L 326, 29 A2d 617-620 (1943).

Descriptors: *New Jersey, *Water rates, *Subsurface waters, *Water supply, Legislation, Diversion, Cities, Regulation, Judicial decisions, Legal aspects, State governments, Administrative agencies, Rivers, Water management (Applied), Local governments, Water allocation (Policy), Eminent domain, Water utilization, Percolating water, Wells, Surface waters.

Defendant commission pursuant to statute passed two resolutions establishing: (1) a minimum rate to be charged for the diversion of surface water in excess of a statutory minimum; and (2) fixing a different rate for water diverted from subsurface, well or percolating water supplies. Plaintiffs, public bodies organized for the purpose of providing a public water supply, objected to the Commission's resolutions. It was contended that the rate exceeded that allowed by law. Plaintiffs also argued that the statute was unconstitutionally discriminatory in not providing a uniform rate for both the diversion of surface and subsurface waters. Upon consideration of the statute involved, the court held that the commission had fixed a rate in excess of that allowed by law for the diversion of waters. However, the statute was constitutional in that there was such a substantial difference between the respective conditions relating to surface and subsurface waters as would sustain a difference in rate for diversion from each. (Barnett-Florida)
W70-08666

THE RELEVANCE OF BENEFIT COST ANALYSIS FOR ECONOMIC DEVELOPMENT,
Rhode Island Univ., Kingston.
David W. Fischer.
Engineering Economist, Vol 15, No 2, p 63-80, Winter 1970. 18 p, 20 ref.

Descriptors: *Benefit-cost ratios, Economics, Project planning, Costs, Foreign countries, Bibliographies, United States, *Social values, Public works, Payments, Investment, Decision making, Projects, Theory.
Identifiers: *Benefit-cost analysis, *Economic growth, Incentives, Developing countries.

The Western World's benefit-cost analysis is assumed a viable concept for planning economic development. Such an analysis relies heavily upon a theoretical base bearing little relationship to the overall context of development decisionmaking. An effort is made to denote the factors distorting the theoretical results of benefit-cost analysis. The structure of the economy obviates the direct applicability of such models; the values inherent in the Western World's benefit-cost approach rest in the economic context where they were formulated, with hidden costs for underdeveloped economies. (USBR)
W70-08678

AN APPLICATION OF SPATIAL EQUILIBRIUM ANALYSIS TO WATER RESOURCE ALLOCATION,
Guelph Univ. (Ontario); and University of New England, Armidale (Australia).
For primary bibliographic entry see Field 06A.
W70-08693

COST-SHARING FOR FEDERAL WATER RESOURCE PROGRAMS WITH EMPHASIS ON FLOOD PROTECTION,
Central Connecticut State Coll., New Britain.
James C. Loughlin.
Water Resources Research Vol 6, No 2, p 366-382, April 1970.

Descriptors: *Cost-sharing, *Government, *Water resource development, Optimization, Economic efficiency, Project costs, Planning, Flood control, Federal government, Financing, Water law, Benefits, Cost-benefit analysis, Recreation, Drainage, Reservoirs, Economic justification.
Identifiers: *Equity, *Efficiency, *Cost distributions.

The purpose of this paper is to highlight the inefficiencies and inequities that can arise under existing cost-sharing provisions for federally assisted water resource programs. The author points out that differences in cost-sharing may cause (1) other than the least-cost alternative to be chosen; (2) the optimal scale may not be chosen; and (3) there may be less than optimal use of existing capacity. The equity problems of differing cost-sharing arrangements include: (1) DIFFERING PATTERNS OF REIMBURSABLE COST DISTRIBUTIONS FOR SIMILAR PROGRAMS, (2) the tilting of project costs toward nonreimbursable functions, and (3) the arbitrary nature of existing cost-sharing provisions. Case studies pertaining to flood control are presented to illustrate several of the above points. A uniform cost-sharing policy for flood protection is also proposed. (Murphy-Rutgers)
W70-08697

A WELL SUPPLY IS BEST FOR VICKSBURG,
Allen and Hoshall, Memphis, Tenn.
Lorin B. Allen.
The American City Vol LXXXV, No 5, p 125-129, May 1970.

Descriptors: *Costs, *Economic evaluation, *Water supply, *Rivers, *Well water, Transportation, Filtration, Water quality, Pollution, Hardness, Treatment cost, Benefits, Temperature, Aeration, Filtration, Lime, Reservoir, Instrumentation, Storage, Soil analysis.
Identifiers: *Vicksburg, Consistency, Automation

This paper discussed the economic and hydrological factors involved in the choice between using a well or a river as the municipal water supply in the city of Vicksburg, Mississippi. The cost of the well water was found to be greater than that of the river. However, the quality of the well water was better and more consistent than that of the river and was less susceptable to the possibility of future pollution. In addition, the well water made for simpler plant control, thus cost-benefit analysis dictated that well water be used. The treatment process is described in detail with special attention given to the plant design and distribution system. (Murphy-Rutgers)
W70-08705

STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
Fristoe Goddard Keig.
American Water Works Association Journal, Vol 62, Apr 1970, p 215-219.

Descriptors: *Public utilities, *Water works, *Municipal water, *Cities, Urbanization, Water rates, Water utilization, Local governments, State governments, Legislation, Use rates, Costs, Economics, Budgeting, Cost sharing, Water policy, Comparative costs, Financing, Administration, Taxes, Political aspects, Coordination, Supervisory control (Power).

The vast majority of water systems serving municipalities in the United States are publicly owned and regulated primarily by city councils. These councils must approve the budget, rate structure, and extension policies of the utility. Except as to extension policies outside city limits and the rates charged in those areas, very few states regulate municipally-owned water utilities. Some problems arise in attempting to operate the municipal water systems as business enterprises. There are problems of coordination and cooperation with other departments whose functions involve use of municipal water. Often the necessary cooperation is lacking. Secondly, a municipal water system may be used to subsidize other governmental functions, thus reducing the expansion capability of the system and affecting its ability to set fair rates. There are also problems with political influence in personnel policies, extension policies and rate determination. The foregoing problems are not as prevalent in independently owned or state-regulated utilities. (Hubener-Florida)
W70-08799

REVERSE OSMOSIS CAN CUT COST OF WATER TREATMENT,
Gulf General Atomic, Inc., San Diego, Calif.
For primary bibliographic entry see Field 05F.
W70-08851

ECONOMICS OF THERMAL DISCHARGES,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 05G.
W70-08852

WASTE WATER CHARGES IN GREAT BRITAIN,
West Hertfordshire Main Drainage Authority, Rickmansworth (England).
For primary bibliographic entry see Field 05D.
W70-08853

FEDERAL EVALUATION OF RESOURCE ALLOCATION INVESTMENTS: A CASE STUDY,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 06A.
W70-08861

IS WATER DIFFERENT,
Department of Energy, Mines and Resources, Ottawa (Ontario). Policy and Planning Branch.
Frank Quinn.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 243-246, 1969. 9 ref.

Descriptors: *Water distribution (Applied), *Water allocation (Policy), *Water law, *Administration, *Water policy, Water demand, Water utilization, Equitable apportionment, Legal aspects, Planning, Water rights, Water requirements.
Identifiers: *Water resources policy.

At one time, most of nature's resources were made readily available to users on the Western frontier, as part of a public policy which encouraged settlement and development. Today only water remains so free to its developers and, at the same time, so dependent on governmental regulation. The costs of manipulating this resource which appears and reappears through the range of competing human pursuits and natural balances, have indeed become more, rather than less, difficult to evaluate. Analogies may be expedient; but it appears at best premature, and at worst irresponsible, to suggest that water can be marketed as a commodity essentially no different from a bushel of wheat or a barrel of oil. (See also W70-08597)
W70-08997

6D. Water Demand

STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
For primary bibliographic entry see Field 06C.
W70-08799

IS WATER DIFFERENT,
Department of Energy, Mines and Resources, Ottawa (Ontario). Policy and Planning Branch.
For primary bibliographic entry see Field 06C.
W70-08997

6E. Water Law and Institutions

CHESAPEAKE AND O RY V SALYER (ACTION FOR DAMAGES CAUSED BY PERMANENT STRUCTURE BARRED BY STATUTE OF LIMITATIONS).

272 Ky 171, 113 SW2d 1152-1158 (1938)

Descriptors: *Kentucky, *Flood damage, *Obstruction to flow, *Bridges, Judicial decisions, Legal aspects, Damages, Overflow, Floods, Streamflow, Flow, Streams, Backwater, Structural members, Piles (Foundations), Structures, Barriers, Dams, Structural design, Railroads, Legislation, Land tenure, Remedies.
Identifiers: *Statutes of limitation.

In an action for damages caused by overflow of water, plaintiffs alleged that defendant railroad company's bridge was so improperly constructed as to create an accumulation of drift and debris in a creek thereunder. This accumulation and the resultant obstruction to flow caused a water backup which inundated plaintiffs' lands. Defendant argued that plaintiffs' action was barred by a statute of limitation requiring suit to be brought within five years of the initial damage. The Court of Appeals of Kentucky stated that the statute operated as a bar only where a single recovery was required for all damages, past and future. The statute would not run where recurring recoveries for recurring damages were possible. Where a permanent structure is negligently constructed and cannot be reasonably repaired to avoid recurring injuries, there must be a single and not recurring recoveries. Plaintiffs had proceeded under the theory that the bridge was such a permanent structure incapable of repair. Since plaintiffs could obtain only a single recovery under such theory, this action was held barred by the statute of limitation. (Snow-Florida)
W70-08663

HOBAN V BUCKLIN (PRESCRIPTIVE RIGHTS TO LAKE SHORE).

184 A 362-369 (N H 1936).

Descriptors: *New Hampshire, *Lake shores, *Prescriptive rights, *Recreation, Lake beds, Lakes, Public rights, Boating, Swimming, Navigation, Navigable waters, Remedies, Legal aspects, Judicial decisions, Structures, Docks, Shores, Recreation facilities, Land use, Right-of-way, easements, Relative rights, Land tenure, Real property.
Identifiers: *Injunction (Temporary).

Plaintiff operated a boys camp during the summer season. Incident to the camp's operation, plaintiff used a lake and a portion of the abutting land thereto located on the opposite side of a highway from the camp. Plaintiff's grantor had constructed a wharf and boathouse over the lakebed, which plaintiff used in conjunction with swimming and boating. To that portion of the lakefront which was used in connection with his camp, plaintiff claimed a prescriptive right. Plaintiff contended that his non-occupancy during the periods when the camp was not open could not alone interrupt his continued possession. He did not voluntarily abandon such possession nor did defendant, who claimed title to the property, actually disturb plaintiff's exercise of his right-of-way. The court permitted plaintiff to tack the period of his grantor's adverse use of the lake and adjoining property onto his own holding periods, finding that plaintiff's rights had ripened into an easement by prescription. The court refused to enjoin any temporary trespass, as a legal remedy at law was available to defendant. (Finman-Florida)
W70-08669

THE BRANDYWINE PLAN,
Pennsylvania Univ., Philadelphia.
For primary bibliographic entry see Field 06B.
W70-08690

NATURAL RESOURCES AND RESEARCH ADMINISTRATION,
Economic Research Service, Washington, D.C.
For primary bibliographic entry see Field 06B.
W70-08699

WATER MANAGEMENT INNOVATIONS IN ENGLAND,
Michigan Univ., Ann Arbor.
Lyle E. Craine.
Washington, D.C. Resources For the Future, Inc, 1969. 123 p.

Descriptors: *Water management, *Water law, *Economic evaluation, Institutions, Government, Institutional constraints, Financing, History, Water supply, Demand, Water resource development, Conservation, Wastes, Population, Costs, Planning, Taxes, Economic efficiency, Flood control, Rivers, Income, Construction, Discharge.
Identifiers: *England, *Water Resources Act, River Authority, Licensing.

This study describes and evaluates the policy and institutional aspects of the British system of water management. The legal powers, the administrative structure and the provisions for the financing of water resources are described in historical context with the aim of determing if they provide an institutional setting favorable to water management. As a basis for the evaluation, the concept of water management is examined and elaborated. Its characteristics and the conditions necessary for its effective pursuit are identified and institutional criteria are proposed. The monograph was presented in the belief that the British experience may be instructive in the search for effective policies and institutions to deal with water use and development in the large urbanizing regions of the United States. (Murphy-Rutgers)
W70-08702

INPUT-OUTPUT TECHNIQUES FOR URBAN GOVERNMENT DECISIONS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 06B.
W70-08704

DANFORTH V UNITED STATES (TAKING OF LAND FOR LEVEE CONSTRUCTION).

105 F2d 318-321 (8th Cir 1939).

Descriptors: *Missouri, *Mississippi River, *Levees, *Easements, Alluvium, Floods, Flood control, Flood protection, Embankments, Legislation, Judicial decisions, Legal aspects, Federal government, Land tenure, Mississippi River Basin, Historic flood, Floodways, Diversion structures, Damages, Diversion.

Appellant owned land a few miles inland from the Mississippi River. The federal government constructed levees on a part of appellant's land to aid in flood control. Appellant contended that this was a taking of his property within the provisions of the Mississippi River Flood Control Act of 1928. The Act provided for purchase of flowage rights for 'additional destructive flood waters that will pass by reason of diversions from the main channel of the Mississippi River.' The court, in holding for the United States, stated that the construction of a set-back levee did not constitute a taking of appellant's property. Further, the government acquired a flowage easement over appellant's lands for water that would be diverted there by the set-back levee. The levee would not divert any additional water from the main channel of the river and, therefore, appellant was not entitled to compensation under the Act. (Hubener-Florida)
W70-08748

LYNN V UNITED STATES (EMINENT DOMAIN: COMPENSATION FOR OBSTRUCTION OF LAND DRAINAGE CAUSED BY INCREASED BACKWATER LEVEL).
110 F2d 586-590 (5th Cir 1940).

Descriptors: *Drainage, *Subsurface drainage, *Backwater, *Eminent domain, Dams, Subsurface runoff, Tennessee, Tennessee River, Tennessee Valley Authority Project, Federal government,

looding, Project planning, Surface drainage, rainage waters, Watersheds (Basins), Surface runoff, Relative rights, Judicial decisions, Drainage ystems, Compensation, Obstruction to flow, iddance (Legal aspects), Repulsion (Legal spects), Easements, Water level fluctuations.

n an action to recover the value of easements, laintiff contended that the United States had, by aising the level of the backwater of a Tennessee 'alley Authority dam, obstructed the drainage of is land. The land was drained by a system of natual underground caves, by underground drains, and y surface drainage. The obstruction caused surace water to be impounded so as to permanently amage his property. Plaintiff contended that he ad an implied easement to discharge his drains hrough lands previously deeded by him to the Jnited States and that obstruction to drainage mounted to the taking of property, the easement, vithout compensation. The court held that plaintiff lid have an easement and that such was property vhich could not be taken without compensation. Iowever, the United States, in exercising its power ver navigable streams, may raise the level thereof nd thereby obstruct the drainage of surface waters n nearby lands. Even though damages occur, the and is not taken, in the constitutional sense, unless he waters of the river are backed upon the land. The damages caused by the obstruction to the drainage was not a taking of property, and plaintiff was not entitled to compensation. (Snow-Florida)
W70-08749

UNITED STATES V BAILEY (REAL PROPERTY VALUATION IN CONDEMNATION PROCEEDINGS FOR TENNESSEE VALLEY AUTHORITY PROJECT).
115 F2d 433-434 (5th Cir 1940).

Descriptors: *Tennessee Valley Authority Project, *Condemnation, *Property values, *Land appraisal, Federal government, Judicial decisions, Adjudication procedure, Legal aspects, Eminent domain, Condemnation, Governments, Value, Compensation, United States, Crop production, Evaluation, Real property, Land use, Forests, Land, Cultivated lands, Irrigable land, Arable land.

Plaintiff United States government proceeded against defendant landowner to condemn land for use by the Tennessee Valley Authority. The sole issue was the value of three tracts of land, which were a mixture of creek bottom land, timber land, open hillside and minimal improvements or cultivation. Although defendant contended that the land was suitable for cultivation, his failure to cultivate it for 38 years supported plaintiff's evidence that the best use of the land was for growing timber. Lacking evidence of similar sales involving willing buyers and sellers, the court held that evidence of prices paid by plaintiff in similar nearby condemnation proceedings was inadmissable. The award made by the commissioners appointed by the district court was affirmed. (Liptak-Florida)
W70-08750

UNITED STATES V WEST VIRGINIA POWER CO (LEGALITY OF MULTIPLE PURPOSE PROJECT CONSTRUCTED PURSUANT TO EXECUTIVE ORDER).
122 F2d 733-739 (4th Cir 1941).

Descriptors: *West Virginia, *Eminent domain, *Federal project policy, *Condemnation, Flood control, Reservoirs, Dams, Water conservation, Channel improvement, Navigation, Federal government, Watershed management, Judicial decisions, Legal aspects, River regulation, Watercourses (Legal), Legislation, Compensation, Electric power production, Standards, Projects.

Petitioner United States brought action against the West Virginia Power Company to condemn land for the erection of a flood control, power and navigation dam and reservoir. Defendants contended that the executive order to construct the project was void, as the project had neither been authorized by Congress nor had it met the recommendations of the Chief of Engineers of the Army. Defendants further contended that the project was unconstitutional since it was a multiple purpose project. The court held that the executive order authorizing the project was not bound by the conditions within the recommendations of the Chief of Engineers, and consequently the order was valid. Furthermore, in subsequent legislation the project had been approved by Congress. The project was, therefore, within the requirements of the National Industrial Recovery Act. The project was held not to be affected by certain requirements pertaining to state-federal cooperation as it had been specifically exempted by Congress. In addition, the court held that it is for Congress to determine what type of project will best serve the constitutional purpose it is pursuing. The judgment for defendants was reversed, and the lower court ordered to pass on the government's motion for immediate possession. (Price-Florida)
W70-08751

UNITED STATES V TILLEY (THE RIGHT TO SEEPAGE AND THE ASSIGNMENT OF APPROPRIATIVE RIGHTS).
124 F2d 850-864 (8th Cir 1941).

Descriptors: *Nebraska, *Appropriation, *Federal-state water rights conflicts, *Seepage, United States, Federal government, Judicial decisions, Legal aspects, Legislation, Natural flow doctrine, Preferences (Water rights), Prior appropriation, Public rights, Relative rights, State governments, Federal jurisdiction, Unappropriated waters, Watercourses (Legal), Irrigation, Irrigation systems, Irrigation programs, Return flow, Water reuse, Reclamation, Contracts.
Identifiers: *Public waters.

Two issues involving federal-state water rights conflicts were raised by this case: (1) whether defendant engineer for the state of Nebraska had transfered to plaintiff United States its appropriative rights to the natural flow waters of the North Platte River; and (2) whether defendant had the right to interfere with plaintiff's collection of seepage waters from irrigation lands located in plaintiff's North Platte Irrigation Project. Plaintiff and defendant had entered into a contract wherein plaintiff had agreed to release from its stored sources into the North Platte River an amount of water which, added to the water defendant would be entitled to be appropriation, would aggregate 180,000 acre feet per year. Delivery of such water would be accepted as full satisfaction of all of defendant's right to water of the North Platte River. The court held that since the contract did not expressly assign defendant's appropriative rights to plaintiff, the contract did not transfer such rights to plaintiff. As to the second issue, the court held that Nebraska law allowed an appropriator of public waters for use in an irrigation project to collect seepage waters upon any land under such project and to re-use them. The United States, as any other appropriator, was protected by this law. (Clarke-Florida)
W70-08752

UNITED STATES V ELLIOTT (OWNERSHIP OF BEDS OF NON-NAVIGABLE WATERS).

131 F2d 720-724 (10th Cir 1942).

Descriptors: *United States, *Boundary disputes, *Ownership of beds, *Riparian rights, Boundaries (Property), Contracts, Federal government, Federal jurisdiction, Judicial decisions, Land tenure, Legal aspects, Legislation, Proprietary power, Public rights, Relative rights, Reservation doctrine, Riparian land, Riparian waters, Usufructuary right, Non-navigable waters, Islands, Rivers.

In 1832 defendant United States granted to the Seneca Nation a tract of land whose boundary on the east was described as 'all land on the west side of the Grand River, a non-navigable stream.' Plaintiff acquired from the Senecas title to an island entirely located west of the midline of the river. Defendant claimed that such title was invalid because the land granted to the Senecas extended only as far as the west bank of the river. The court held that a grant of land bounded on a non-navigable stream carries the exclusive right and title of the grantee to the center of the stream unless the terms of the grant clearly denote the intention to stop at the edge of the stream. The language of the treaty did not indicate such an intent. Consequently, plaintiff's title to the island was upheld. (Clarke-Florida)
W70-08753

UNITED STATES V COMMODORE PARK, INC (RIGHT OF THE UNITED STATES TO TAKE PROPERTY FOR THE IMPROVEMENT OF NAVIGATION).
324 US 386, 65 S Ct 803-806 (1945).

Descriptors: *United States, *Virginia, *Riparian land, *Riparian rights, Federal government, Streams, Alteration of flow, Dredging, Navigation, Eminent domain, Landfills, Real property, Judicial decisions, Legal aspects, Dams, Shores, Planning, Non-structural alternatives, Regulation, Compensation, Fishing, Tidal waters, High water mark, Low water mark, Navigable waters.

Defendant United States conducted a dredging operation in a tidewater navigable bay and deposited the dredged matter in a navigable arm of the bay, thereby destroying its navigability. Plaintiff, who owned property along the arm, brought action for damages resulting from the 'taking' of his riparian right of access to the navigable waters. Defendant's answer alleged that plaintiff's riparian right of access to the navigable waters was subordinate to the government's plenary authority over navigable waters of the United States in aid of navigation or commerce. The district court held the entire project had no substantial relation to navigation or commerce and awarded damages for plaintiff. The Circuit Court of Appeals affirmed, but the United States Supreme Court reversed, stating that the dredging was done in aid of navigation and that the United States does have the power to control and regulate navigable waters in the interest of navigation and commerce without payment of compensation. As against the demands of commerce, riparian landowners whose lands are invaded have no right for compensation for the loss of access to navigable waters even though such loss may cause a decrease in the value of their property. (Barnett-Florida)
W70-08754

STEWARD V UNITED STATES (TITLE TO SWAMP LAND ADJACENT TO GOVERNMENT HOLDINGS).
316 US 354, 62 S Ct 1154-1159 (1942).

Descriptors: *United States, *Islands, *Tidal marshes, *Boundary disputes, Land tenure, Boundaries (Property), Bays, Marshes, Swamps, Bodies of water, Coastal marshes, California, Governments, Legislation, Federal government, Public lands, Relative rights, Judicial decisions, Legal aspects, Military aspects, Beds under water, Surveys, Mapping, Real property.
Identifiers: *Swamp Lands Act of 1850.

The United States sought to quiet title to an area of tule marsh adjacent to an island owned by the government in a bay. The government had purchased title to the island and claimed that the land in question was part of the purchase because it was joined to the island by a narrow neck. Defendants claimed title to the swamp under the Swamp Lands Act of 1850 and argued that it was not part of the original grant under which the government claimed title to the island. Defendant claimed that the connecting neck was often under water at high tide, and therefore the government's claim could not extend to land beyond the high water mark. The U. S. Supreme Court, accepting the findings of

fact of the trial court, found that the government's claim ran only to the high water mark and thus did not extend to the area separated by high tide from the island. The Circuit Court decision for the government was reversed. (Barker-Florida)
W70-08755

UNITED STATES V CHICAGO, M, ST P AND P RR (FEDERAL COMPENSATION FOR CONDEMNATION OF FLOODED LANDS BELOW HIGH WATER MARK: IMPROVEMENT OF NAVIGATION).

312 US 592, 313 US 543, 61 S Ct 772-776 (1941).

Descriptors: *United States, *Condemnation, *Navigable rivers, *Compensation, Eminent domain, Mississippi River, Right-of-way, Riparian rights, Riprap, Bank protection, Embankments, Shore protection, Navigable waters, Navigation, Railroads, Water levels, High water mark, Low water mark, Easements, Relative rights, Ownership of beds, Judicial decisions, Legal aspects, Flooding, Federal government.

Plaintiff United States brought a condemnation action to acquire the right to flood a right-of-way and embankment owned by defendant railroad companies. Plaintiff claimed the right through its power over commerce and navigability of rivers. Defendants operated a railroad track and telegraph line on the west bank of the Mississippi River, and part of their right-of-way lay between the high and low water marks. Defendants claimed ownership to the low water mark and argued that the government must compensate them if the water level was raised through a plan to improve the navigability of the river. The government claimed the right to raise the water level to the ordinary high water mark without compensation to riparian owners. The U. S. Supreme Court held that the government's interest in navigation included all the lands below the high water mark and that exercise of power within those limits was not an interference with private property rights. No compensation was awarded. (Barker-Florida)
W70-08756

UNITED STATES V APPALACHIAN ELECTRIC POWER CO (DAM CONSTRUCTION: INTERFERENCE WITH NAVIGATION AND COMMERCE).
311 US 377, 61 S Ct 291-312 (1940).

Descriptors: *United States, *Navigable rivers, *Hydroelectric project licensing, *Dam construction, Interstate, Governments, Administrative agencies, State governments, Interstate rivers, Surface waters, Electric power, Legislation, Legal aspects, Political aspects, Navigation, Damsites, Virginia, West Virginia, Hydroelectric plants, Judicial decisions, Multiple-purpose projects, Dams, Supervisory control (Power), Navigable waters, Eminent domain.

The United States sought to enjoin the construction of a dam and an electric power plant on a river which flowed through Virginia and West Virginia. The United States claimed the construction was proceeding without the grant of a license for such by the Federal Power Commission pursuant to control by the federal government over navigable rivers and interstate commerce. Defendant electric power company argued that the river was not navigable and thus no license was required. Defendant further argued that even if the river were navigable and the license were necessary, the provisions of the license as offered were illegal and unconstitutional in that they usurped state regulation and amounted to an uncompensated taking. The United States Supreme Court found that the river was navigable and that the provisions of the license were wholly within the bounds of congressional control over navigation and interstate commerce. The lower court decisions in favor of defendant were reversed. (Barker-Florida)
W70-08757

CHESEBRO V LOS ANGELES COUNTY FLOOD CONTROL DIST (ASSESSMENTS OF LANDS BY DRAINAGE DISTRICTS).
306 US 459 S Ct 622-625 (1939).

Descriptors: *United States, *Drainage districts, *Assessments, *Costs, Judicial decisions, Legal aspects, Administrative agencies, Flood control, Operation and Maintenance, Regulation, Benefits, Drainage systems, Financing, Taxes, Legislation, California, Cost allocation.

Plaintiff owned taxable real property within defendant flood control district but outside certain drainage districts that were transferred to defendant pursuant to statute. Plaintiff contended that the statute, which authorized the administrative board of the district to levy special assessments on his land within the flood control district for the purpose of paying the debts and obligations of other special assessment districts without regard to the accrual of benefits to the lands assessed, would deprive him of his property without due process of law in violation of the 14th amendment. From a denial by the Supreme Court of California to restrain this assessment on his land, plaintiff appealed to the Supreme Court of the United States. In affirming, the Supreme Court held that in the absence of flagrant abuse or purely arbitrary action, a state may establish local districts to include lands that it finds will be specially benefited by drainage, flood control or other such improvements. Furthermore, to acquire, construct, maintain and operate such burdens on those lands deemed benefited. (Barnett-Florida)
W70-08758

IN RE COUNTY DITCH NO 50, FARIBAULT COUNTY (PARTIES DIRECTLY AND INDIRECTLY AFFECTED BY LATERAL DRAIN AND DITCH IMPROVEMENT PROCEEDINGS).
177 NW2d 54-56 (Minn 1970).

Descriptors: *Minnesota, *Laterals, *Ditches, *Adjudication procedure, Drains, Drainage, Administrative agencies, Administrative decisions, Tile drainage, Tile drains, Tiles, Surface drainage, Surface runoff, Surface waters, Local governments, Judicial decisions, Runoff, Outlets, Outlet works, Drainage effects, Water control, Legal aspects, Riddance (Legal aspects), Land tenure, Remedies.
Identifiers: *Improvements (Drainage).

Plaintiff landowners appealed from an order of defendant county commission approving construction of a lateral drain which sould empty into an existing county ditch. Plaintiffs contended that the existing ditch, which adjoined their property, was inadequate to handle the increased flow of water from the proposed lateral drain, thereby requiring that they be given statutory notice of improvement proceedings and an opportunity to intervene. Defendant contended that plaintiffs were only indirectly affected and that only those who lived alongside the proposed lateral drain were proper parties to improvement proceedings. The court discussed and distinguished apparently conflicting authority and held that plaintiffs were only indirectly affected by the proposed drain and were not proper parties to improvement proceedings since the lateral drain would replace an existing private tile drain. If, however, the lateral drain had required a new outlet into the existing ditch, landowners along the ditch would be proper parties and notice would be required. The court also noted that plaintiffs still had an adequate remedy through petition for separate proceedings for improvement of the existing ditch. (Liptak-Florida)
W70-08759

PIGORSH V FAHNER (RIGHT TO USE AND OWNERSHIP OF NON-NAVIGABLE WATERS).

177 NW2d 466-470 (Mich Ct App 1970).

Descriptors: *Michigan, *Public rights, *Riparian rights, *Non-navigable waters, Easements, Judicial decisions, Legal aspects, Legislation, Local governments, Ownership of beds, Preferences (Water rights), Prescriptive rights, Proprietary power, Recreation, Relative rights, Riparian land, Riparian waters, State governments, Usufructuary right, Water rights, Watercourses (Legal), Lakes, Navigable waters.

Plaintiffs fenced off the entrance road to their private lake. They had allowed their friends and neighbors access to the lake, without express permission, for more than ten years. Defendant city officials removed the fence, contending that plaintiffs had dedicated the road to public use. Plaintiffs sought to enjoin defendants from further similar action. While suit was pending, plaintiffs spread dirt fill into the lake. The state then intervened as a party defendant on two grounds: (1) that plaintiffs violated a statute requiring a permit to deposit dirt fill in any navigable water body, and (2) that the public had a right to use of the lake for recreational purposes because it was navigable. The court refused both the state's contentions, holding that the term navigable waters means waters capable of being used by the public as thoroughfares for the purposes of commerce, travel and transportation. Plaintiff's lake was landlocked, and consequently was subject to their exclusive use and possession. It was clearly non-navigable and not subject to public use. The court further held that the access road may well have been dedicated to public use, but since its only useful purpose was to provide access to the lake, which was inacessible to the public, defendants could have no valid reason to pursue this claim. (Clarke-Florida)
W70-08760

ESSEX CO V GOLDMAN (ENFORCEMENT OF COVENANT TO PURCHASE WATER).
258 NE2d 526-530 (Mass 1970).

Descriptors: *Massachusetts, *Water costs, *Rent, *Industrial water, Water users, Water demand, Costs, Mills, Industrial plants, Facilities, Canals, Dam design, Surface waters, Mill dams, Water supply, Land use, Judicial decisions, Legal aspects, Canal design, Canal construction, Water utilization.

Plaintiff dam owner and water supplier sought enforcement of a covenant to pay rent for water supplied by plaintiff to land owners. Plaintiff had built a dam and canals in order to supply water for mill operation and had created a perpetual covenant for the rents to run with the land where the mills were located. Defendants, ultimate grantees of the land on which a mill was located, who did not use the water for mill operation, argued that the covenant was personal to the original grantees and thus not in force as to them. Defendants further claimed that abandonment of the use of land for mill operation constituted a radical change and that therefore the covenant was not binding. The Supreme Judicial Court of Massachusetts, affirming the trial decision for plaintiff, ruled that the covenant to pay rent for water ran with the land and was not personal in nature. The court also held that non-use of the water for mill power was not an abandonment since the water was still used for industrial purposes. (Barker-Florida)
W70-08761

LOCHTE V CICCARELLI (ACCESS TO WATER).
270 App Div 798, 60 NYS2d 126-127 (1946).

Descriptors: *New York, *Access routes, *Navigable waters, *Non-navigable waters, Water policy, Judicial decisions, Legal aspects, Roads, Lake Ontario, Bodies of water, Surface waters, Great Lakes, Ponds, Easements, Relative rights.
Identifiers: *Way of necessity.

In a per curiam decision where facts were not stated, the Supreme Court of New York, Appellate Division, ruled that it was error to deny a way of necessity from defendant's land across plaintiff's land to Lake Ontario based only on a finding that a

ond next to defendant's land which connected ith Lake Ontario was navigable, when it was own that the pond had not been used for naviga- on since 1890. The access route across plaintiff's nd to Lake Ontario was granted. (Barker-lorida)
/70-08762

IOYER V NEW YORK (WATER SEEPAGE AMAGE FROM STATE BARGE CANAL PERATIONS).

) NYS2d 203-208 (Ct Cl 1944).

escriptors: *New York, *New York State Barge anal, *Explosives, *Canal seepage, Damages, eepage, Dams, Dikes, Canals, Drainage, Ditches, urface drainage, Construction, Operations, Land se, Farms, Judicial decisions, Remedies, Legal spects, Excavation, Crop production, Adjudica- on procedure, State governments, Maintenance.
lentifiers: Negligence, Causes (Legal).

laintiff landowners sought to recover damages to ieir property allegedly caused by defendant's egligent operation of the New York State Barge anal. Plaintiffs claimed that water seepage from rainage ditches which flowed into the Canal was aused by defendant's blasting operations and ailure to properly maintain the ditches. It was urther alleged that such seepage diminished the roductivity of plaintiffs' property. Defendant ar- ued that its blasting in constructing a distant dike ould not have affected the ditches and further laimed that title to the ditches had been trans- erred long before the seepage occured, thus relieving the state of maintenance responsibility. The Court of Claims of New York, dismissing plaintiffs' laim, ruled that in an action for water seepage damage from negligent operations of a canal, it must be shown that the state's operation directly contributed to the damage. The court held that the evidence was insufficient to support the claim. (Barker-Fla)
W70-08763

IN RE WATERFRONT AND HARBOR, EAST RIVER, BOROUGH OF MANHATTAN, CITY OF NEW YORK (COMPENSATION FOR CONDEMNATION).

268 App Div 131, 49 NYS2d 474-477 (1944).

Descriptors: *New York, *Cities, *Condemnation, *Riparian rights, Condemnation value, Compensation, Eminent domain, Legal aspects, Value, Water resources development, City planning, Riparian land, Governments, Construction, Docks, Relative rights, Highways, Road construction, Land use, Remedies, Judicial decisions, Property values.

In a condemnation proceeding by the City of New York for the construction of a marginal street to improve the waterfront, the landowners affected complained of uncompensated damage. Although the original plan for the marginal street was the basis of the condemnation, the landowners showed that the city contemplated a further taking in order to construct an elevated street. It was shown that the additional taking changed the property of the landowners from waterfront to inland property. The Supreme Court of New York, Appellate Division, ruled that where the original condemnation plan for the construction of a marginal street to improve the waterfront also contemplated a further taking for the construction of an elevated highway, waterfront property owners whose land was thus changed to inland property were entitled to compensation for the extinguishment of their riparian rights. (Barker-Florida)
W70-08764

NIGHTINGALE V STATE (CLAIM FOR DAMAGES DUE TO EROSION CAUSED BY CANAL OPERATION).
46 NYS2d 525-528 (Ct Cl 1944).

Descriptors: *New York, *Erosion, *Alteration of flow, *New York State Barge Canal, Canals, Damages, Remedies, State governments, Streams, Diversion, Jucicial decisions, Legal aspects, Flow rates, Legislation, Flow augmentation, Land tenure, Water transfer, Bank erosion, Accretion (Legal aspects), Intake gates, Structures, Bank erosion, Adjudication procedure.

Plaintiffs claimed that increased flow through the New York State Barge Canal had resulted in erosion of plaintiff's land adjoining the canal. The court found that, while some of the increased flow was due to seasonal rainfall, the state had contributed to the flow by diverting additional water from a near-by stream. The court held that it was unnecessary to show negligent operation of the canal; plaintiffs needed only show that through the use and management of the canal the state had damaged them. This was proven to the court's satisfaction. The fact that some part of the damage had resulted from natural causes was held not to be a bar to recovery. However, the damages had to be apportioned between natural causes and state canal operation. As the damage was a continuing wrong, plaintiffs were not bound by a short statute of limitations. The court allowed recovery. (Caldwell-Florida)
W70-08765

IN RE WATERFRONT AND HARBOR OF CITY OF NEW YORK (MUNICIPAL ACQUISITION OF WATERFRONT PROPERTY).
30 NYS2d 187-192 (Sup Ct 1941).

Descriptors: *New York, *Cities, *Condemnation, *Bulkheads, Eminent domain, Damages, Legal aspects, Rivers, Cranes, Docks, Bulkhead line, City planning, Water resources development, Legislation, Governments, Judicial decisions, Land tenure, Project planning, Remedies, Piers, Condemnation value.

The city of New York brought proceedings for the acquisition of waterfront property on the East River. The city based its action on a resolution which recommended the acquisition for the purpose of a marginal street in the interests of commerce and navigation. Owners of the property objected and argued that the proceeding was in fact one of condemnation, under which the city should offer compensation for interference with their bulkhead rights. The original bulkhead grants contained the rights of wharfage and cranage. The city claimed that because those rights had never been exercised, there was no interference therewith. The Supreme Court of New York ruled that the action was not one of condemnation, but also held that damage was done the landowners when the city took away their bulkhead rights. Therefore, the city had to pay for those damages. (Barker-Florida)
W70-08766

ROBB V STATE (NEGLIGENT CANAL STRUCTURE AS CAUSING SEEPAGE FLOODING GRAVEL PITS).
262 App Div 37, 28 NYS2d 107-108 (1941).

Descriptors: *New York, *Groundwater movement, *Canal construction, *Canal seepage, Percolation, Flood damage, Canal embankments, Groundwater barriers, Overlying proprietor, Surface-groundwater relationships, Legal aspects, Judicial decisions, Water table, Damages, Drainage, Gravels, Land tenure, Relative rights, Canals.

Plaintiff landowner claimed that negligent construction and maintenance of defendant's nearby canal had caused canal waters to seep onto his farm and flood gravel pits thereon. The trial court found that the canal seepage had raised the water level and had prevented normal drainage of plaintiff's land and gravel pit. Reversing per curiam, the appellate court held that the evidence established only that canal waters exerted pressure upon the soil beneath the canal. Such pressure prevented the groundwater from normally draining beneath the plaintiff's land. Under such circumstances, an adjacent landowner is not liable for interference with underground waters. (Caldwell-Florida)
W70-08767

VANNECK REALTY CORP V CITY OF NEW YORK (CONDEMNATION OF RIPARIAN LAND).
259 App Div 461, 19 NYS2d 544-546 (1940).

Descriptors: *New York, *Condemnation, *Compensation, *Legislation, Local governments, Riparian rights, Boundaries (Property), Eminent domain, Judicial decisions, Legal aspects, Land tenure, Proprietary power, Public rights, Relative rights, Riparian land, Riparian waters, Usufructuary right, Remedies, Highways, Condemnation value.
Identifiers: *Injunction (Prohibitory).

Plaintiff realty corporation sought to enjoin defendant city from condemning a strip of land between plaintiff's land and the East River. Plaintiff claimed that it would be deprived of riparian and wharfage rights appurtenant to its land without just compensation unless the proceedings were enjoined. Plaintiff alleged that defendant intended to use the land for a highway, yet it was proceeding under a section of the Administrative Code which related to acquisition of land for wharf purposes and other improvement of waterfront. The court held that the constitutional right to just compensation for property taken could not be flouted by a taking under the guise of an improvement, if, in fact, the taking contemplates another use. There was no reason, however, why the condemnation court could not consider all matters relevant to the question of whether plaintiff's property, including its riparian and wharfage rights, were being interfered with, even though the taking was for highway purposes. The court dismissed plaintiff's complaint without prejudice to further action. (Clarke-Florida)
W70-08768

HASKELL V STATE (NEGLIGENT OPERATION OF FLOOD CONTROL FACILITIES).

258 App Div 930, 16 NYS2d 550-551 (1939).

Descriptors: *New York, *Flood control, *Flood damage, *Dam failure, Judicial decisions, Legal aspects, Public rights, Relative rights, Riparian land, Riparian waters, Riparian rights, State governments, Usufructuary right, State governments, Watercourses (Legal), Dams, Floods, Lakes, Rivers.

The court concluded per curiam, without a statement of the facts, that damage to plaintiff's cottage property on the shore of Oneida Lake resulted from defendant state's inadequate and negligently maintained flood control facilities at its dam on the Oneida River. (Clarke-Florida)
W70-08769

BENNETT V DELAWARE COUNTY (ACTION TO FORCE CITY AND COUNTY GOVERNMENTS TO REBUILD A WASHED-OUT BRIDGE).
172 Misc 463, 15 NYS2d 591-597 (Sup Ct 1939).

Descriptors: *New York, *Bridge construction, *Local governments, *Remedies, Bridge failure, Flood damage, Bridges, Legislation, Judicial decisions, Legal aspects, Condemnation, Washouts, Cities, Institutional constraints, Streams, Land tenure, Maintenance, Adjudication procedure, Repairing.

Plaintiff, owner of land on both sides of a stream, sought to force defendant city and county governments to rebuild a bridge which had been washed out. The bridge had been the only connection between the two segments of plaintiff's land. Plaintiff argued that the destruction had the same effect as if the bridge had been withdrawn from use by condemnation for unfitness, in which case the

counties were obligated to repair it. The court rejected this argument, and held that the plaintiff could not prevail against the counties concerned since, by statute, the duty to maintain and repair bridges in the area was placed upon the municipalities. The plaintiff could force the municipal government to rebuild the bridge; however, his remedy was an administrative one under a statute providing for petition to the municipality. This remedy was exclusive so that the present action could not be maintained. (Caldwell-Florid)
W70-08770

NEW YORK WATER SERVICE CORP V WATER POWER AND CONTROL COMM'N OF DEP'T OF CONSERVATION.
257 App Div 590, 13 NYS2d 760-765 (1939).

Descriptors: *New York, *Water supply, *Well permits, *Administrative decisions, Water utilization, Groundwater, Legislation, Cities, Judicial decisions, Legal aspects, Domestic water, Water wells, Well regulations, Administrative agencies, Water demand, Water shortage, Decision making, Public benefits, Equitable apportionment, Saline water intrusion, Subsurface waters, Water table, Local governments, Drawdown, Water allocation (Policy).

Petitioner, a public water company, applied to the defendant Commission for temporary authorization to sink wells. This request was grounded on decreased capacity of existing wells due to saline water intrusion and deficient rainfall. The petition was denied, the Commission holding that the request was not justified by public necessity, and that to grant the petition would be inequitable to other municipalities. The court, noting that the Commission had made no factual findings, pointed to expert testimony to the effect that the water supply of Nassau County, which objected to the petition, would not be harmed. Also, the minimum daily water supply in the area was stated to be 165 million gallons daily, while the maximum use, even with the proposed new wells, would be 70 million gallons daily. Any lowering of the water table was stated to be due more to decreased rainfall than to any new consumption of groundwater. Therefore, the court annulled the Commission's decision as arbitrary and capricious, and remanded for further proceedings. (Caldwell-Florida)
W70-08771

HASKELL V STATE (LIABILITY FOR DAMAGES CAUSED BY INADEQUATE DAM DESIGN).
13 NYS2d 192-197 (Ct Cl 1939).

Descriptors: *New York, *State governments, *Flood damage, *Dam design, Judicial decisions, Legal aspects, Natural flow doctrine, Public benefits, Riparian land, Riparian rights, Riparian waters, Usufructuary right, Watercourses (Legal), Flood control, Damages, Overflow, Floodgates, Concrete structures, Dams, Flood protection, Floods, Rainfall, Dam failure, Canals.

Defendant state constructed a dam at the point where Oneida Lake flowed into the Oneida River. The dam contained no floodgates, and during heavy rains much of the riparian land surrounding the lake was flooded. As a result of ensuing damage claims, defendant built floodgates in the dam, and later enlarged them. Plaintiff owned land adjacent to the lake, and during a particularly heavy rainy season, his land was flooded. Plaintiff brought action for damages, claiming that defendant had raised the level of the lake by constructing the dam and had negligently failed to provide for adequate flood control. Defendant claimed that the improved floodgates constituted an adequate flood control device and that plaintiff's land was flooded by excessive rainfall and accumulated surface waters. The court found from the evidence that the floodgates were much too small and inadequate for effective flood control and that defendant had kept the gates partially closed during the heavy rainfall. The court held that lack of adequate flood control measures by defendant caused the flooding of plaintiff's land, and consequently defendant was liable for flood damages resulting thereto. (Clarke-Florida)
W70-08772

NEW YORK WATER SERV CORP V WATER POWER AND CONTROL COMM'N OF DEP'T OF CONSERVATION (REVIEW OF DECISION DENYING WELL PERMITS TO WATER COMPANY).
9 NYS2d 301-302 and 9 NYS2d 302-303 (Sup Ct 1939).

Descriptors: *New York, *Well permits, *Administrative decisions, *Drawdown, Wells, Administrative agencies, Water demand, Legal aspects, Judicial decisions, Cities, Public benefits, Water supply, Water wells, Decision making, Groundwater, Water allocation (Policy), Well regulations, Public utilities, Local governments, State governments.

Petitioner, a public water company, applied to respondent Commission for the sinking of additional wells to enable it to supply water to its customers. New York City and others filed objections on the grounds that granting such permits would deprive certain city residents of their natural water resources and that the amounts proposed to be taken would exceed the available groundwater capacity of the area. The Commission determined that, upon consideration of the present and future needs for water sources in that area, the proposed plans were unjustified. Holding that the proof submitted in connection with the objections was sufficient, the court affirmed the Commission's determination. (Caldwell-Florida)
W70-08773

IN RE NEPTUNE AVE IN CITY OF NEW YORK (DAMAGES IN CONDEMNATION PROCEEDINGS).
254 App Div 690, 3 NYS2d 825-827 (1938).

Descriptors: *New York, *Cities, *Condemnation value, *Riparian rights, Condemnation, Compensation, Eminent domain, Legal aspects, Value, Appraisals, Water resources development, City planning, Riparian land, Structures, Construction, Governments, Judicial decisions, Permits, Administrative agencies, Regulation, Easements, Relative rights, Remedies.

In a condemnation proceeding by City of New York to acquire title to waterfront property, landowners objected to the appraisals as inadequate. One landowner claimed special damages for the removal of a restaurant he had erected on such waterfront property. The landowner contended that such construction was a valid exercise of his riparian rights and that he had been issued a building permit by the dock commissioner. The Supreme Court of New York held that the appraisals were not sufficiently inadequate to warrant a reversal of the awards by the trial court. As to the restaurant owner, the court ruled that erection of such structure was not a proper exercise of riparian rights, that a permit allowing such construction was beyond the authority of the dock commissioner, and that even if the permit had been legal, it was revocable at will and thus conveyed no right, privilege, or easement which was taken away by the condemnation proceedings. The trial court's judgements were affirmed. (Barker-Florida)
W70-08774

MOYNEHAN V STATE (ESTABLISHING THE STATE'S LIABILITY FOR FLOOD DAMAGE).
1 NYS2d 907-908 (Ct Cl 1938).

Descriptors: *New York, *Overflow, *Creeks, *Rainfall intensity, Rain, Rainfall, Artificial watercourses, Backwater, Canals, Cutoff, Flooding, Non-navigable waters, Obstruction to flow, Streams, Cultivated lands, Natural flow, Water conveyance, Water spreading, Legal aspects, Judicial decisions, Watercourses (Legal), Rainfall-runoff relationships, Flood damage, Damages

Plaintiff's cultivated land was flooded and damaged when a creek, abutting her property and flowing into a canal built by defendant state, overflowed during heavy rains. Plaintiff filed her claim in negligence and trespass against defendant for damages, alleging that the flooding was due to water backing out of the canal into the creek, causing it to overflow. The court stated that to create legal liability against the state, facts must be proved that would create legal liability against an individual or a corporation in like circumstances. There can be no recovery for damages resulting from a public improvement effected under legislation authority in the absence of any trespass or negligence. The court found that defendant had no control over the creek, and consequently could not be held responsible for the damages resulting from overflow without proof of some wrongful act on its part. The court held that the burden of establishing defendant's liability was on plaintiff, and such burden had not been met. The court further held that the overflow and flooding had been caused by the heavy rains. (Price-Florida)
W70-08775

LOHMEYER V STATE (FLOOD DAMAGE CAUSED BY DEBRIS BLOCKING ARCHWAY OF STATE AQUEDUCT).
299 NYS 681-682 (App Div 1937).

Descriptors: *New York, *Aqueducts, *Obstruction to flow, *Flood damage, Damages, Canals, Administrative agencies, Floods, Legal aspects, Judicial decisions, Flow, Flooding, Overflow, State governments, Water conveyance.

Defendant state had maintained a certain aqueduct over the Erie Canal for many years. Over a period of time, several of the archways over the canal became clogged with sand, gravel and other debris. When floodwaters were backed up by the obstruction onto plaintiffs' land, they brought suit for damages. The appellate court held per curiam that the evidence was sufficient to establish that the canal authorities had known about the condition and had been negligent in removing it. The lower court judgment for the plaintiffs was affirmed. (Caldwell-Florida)
W70-08776

NORTHERN NEW YORK POWER CORP V STATE (CLAIMS ARISING FROM DAM CONSTRUCTION WHICH NECESSITATED REBUILDING OF A POWERPLANT).
298 NYS 688-717 (Ct Cl 1937).

Descriptors: *New York, *Canals, *Dams, *Hydroelectric plants, Water utilization, Water rights, Industrial use (Water), Relative rights, Legal aspects, Judicial decisions, Eminent domain, Land tenure, Riparian land, Rivers, Governments, Water allocation (Policy), Compensation, Low flow augmentation, Outlets, Surplus water, Hydraulics, Damages, Water level fluctuations, Intake gates, Power head, Water levels.

Defendant state constructed a new dam to replace its old one across a canal. This necessitated the rebuilding of plaintiff's powerplant to take advantage of the increased operating head provided by the raised water level. Plaintiff claimed damages. The court granted damages for 2 parcels of land taken by the dam construction, but disallowed plaintiff's claim for his expense in relocating and rebuilding his powerplant. Such consequential damages were compensable, the court held, but must be balanced against the benefits the plaintiff received from the new dam. The higher head and increased aperture of the new dam had increased the power potential of plaintiff's mill to such an extent as to more than offset any possible damage. The state filed a cross-claim, alleging that plaintiff was entitled to use only so much water as could

scape through the apertures of the old dam, and ought to charge plaintiff for the excess over that mount he had used from the new dam. The court enied this claim, holding that plaintiff had a right o use all the surplus waters not actually needed for he operation of the canal. (Caldwell-Florida)
V70-08777

ELL V CITY OF NEW YORK (INJUNCTION GAINST BUILDERS OF A SEWER IN A ANAL TO PREVENT DESTRUCTION OF IPARIAN RIGHTS).
50 App Div 564, 294 NYS 852-855 (1937).

escriptors: *New York, *Sewers, *Canals, Riparian rights, Competing uses, Judicial decisions, Legal aspects, Damages, Riparian land, iparian water, Navigable water, Navigation, ewage, Construction, Obstruction to flow, Adjudiation procedure, Cities, Local governments.

laintiff owner and plaintiff lessee of property onting on a canal sought to enjoin defendants, lew York City and its contractor, from laying a ewer in the canal. It was contended that the sewer as to be constructed in such a way as to interfere ith plaintiffs' riparian rights. Plaintiffs alleged that he sewer pipe was being placed at a depth which ould obstruct the free and proper use of the canal nd thereby lessen the value of the plaintiffs' proerty. Defendant contended plaintiffs had not alged sufficient facts to show that the construction f the sewer interfered with their rights of navigaon. The appellate court held that the plaintiffs did ot need to plead the exact measurements of the ewer, that the facts pleaded were sufficient, and hat the lower court had improperly dismissed the omplaint. The judgment below was reversed. Price-Florida)
V70-08778

IOMES, INC V ANDERSON (RIGHT TO DIRECT DRAINAGE WATER ALONG NATUAL COURSE OF FLOW).
35 So 2d 680-684 (Miss 1970).

Descriptors: *Mississippi, *Drainage systems, Natural flow, *Drainage effects, Surface drainage, Construction, Dams, Ponds, Real property, Land enure, Judicial decisions, Legal aspects, Rainfall, Excessive precipitation, Surface runoff, Riddance (Legal aspects), Silting, Drainage water, Conrolled drainage, Relative rights, Remedies.

Defendant owned land adjacent to and at a higher levation than plaintiff's land. In preparation for onstruction of a subdivision, defendant cleared his and and installed a drainage system. The drainage ystem directed surface waters along a watercourse o a pond on plaintiff's land. After heavy rains nuch silt was washed into the pond and damaged a lam which was part of the pond. Plaintiff sought lamages and an injunction requiring alteration of he drainage system so that none of its waters would be directed across plaintiff's land. The lower court held for plaintiff, but the Mississippi supreme court reversed. The court found that the drainage system in no way changed the course of natural drainage flow and only drained defendant's land more efficiently. An upper landowner may increase the flow of drainage water off his land as long as he does not gather it into an artificial channel. Further, plaintiff's damages were cuased by unprecedented heavy rainfalls. That, together with the fact that plaintiff prevented defendant from repairing the dam at gunpoint, precluded any damages. (Hubener-Florida)
W70-08779

BALLARD FISH AND OYSTER CO V GLASER CONSTR CO (COMPENSATION FOR TAKING OF PRIVATE PROPERTY).
424 F2d 473-475 (4th Cir 1970).

Descriptors: *Virginia, *Eminent domain, *Condemnation, *Federal jurisdiction, Compensation, Oysters, Aquatic life, Commercial shellfish, Rivers, Natural gas, Construction, Judicial decisions, Legal aspects, Adjudication procedure, State governments, Right-of-way, Easements, Relative rights.
Identifiers: *Oyster bed.

Plaintiff brought action against defendants, a construction company and natural gas corporation, for damages caused by the laying of a gas pipeline through plaintiff's oyster bed in the James River. Plaintiff alleged that defendants had been authorized by the state to exercise the power of eminant domain, and the occupancy of the oyster bed, without condemnation or acquisition of an easement, constituted an unlawful taking of private property without just compensation. The district court dismissed the action for want of a federal question. The court of appeals reversed and held that a public service corporation acts as an agent of the state when exercising the eminent domain power and must provide compensation for property which is appropriated. The occupancy of the oyster bed was not a simple trespass but a taking of property, and a federal question was raised since no provision was made by the state for payment of compensation. Plaintiff was not required to exhaust state remedies because of the absence of compensation provisions and the failure of the state to institute proceedings. (Hubener-Florida)
W70-08780

VILLAGE OF SCHOHARIE V COONS (ACQUISITION OF EASEMENT BY PRESCRIPTIVE RIGHT).

309 NYS2d 545-547 (App Div 1970).

Descriptors: *New York, *Cities, *Conduits, *Tile drains, Drainage systems, Prescriptive rights, Easements, Legal aspects, Judicial decisions, Drainage water, Surface waters, Water conveyance, Waste water disposal, Land tenure, Relative rights, Discharge (Water), Surface runoff, Flooding, Local governments.

Defendant purchased a tract of land in plaintiff village. Defendant subsequently discovered a tile conduit running across his land which formed part of the surface drainage system of the village. Defendant complained to plaintiff that the tile was discharging detergent from a nearby laundry as well as drainage water onto his land, but received no response. Thereupon, defendant took his bulldozer, crushed the tile and buried it. After flooding occurred because of the destruction of the conduit, plaintiff brought action to require restoration of the conduit, contending that it had acquired a prescriptive easement. The lower court held that hostile, actual, notorious, exclusive and continuous possession was required to establish a prescriptive easement and that plaintiff had not established hostile possession because permission had to be presumed in the absence of written records to the contrary. The appellate court reversed, finding that the easement was hostile since the discharge of water interfered with a landowner's rights in his property. Defendant also had constructive notice of the easement and took title to the land subject to it. (Hubener-Florida)
W70-08781

COX V DRAINAGE DIST NO 27 (NOTICE OF HEARING BY DRAINAGE DISTRICT REQUIRED FOR ADDITIONAL ASSESSMENTS).
187 SW2d 887-891 (Ark 1945).

Descriptors: *Arkansas, *Drainage districts, *Assessments, *Adjudication procedure, Administration, Drainage systems, Judicial decisions, Governments, Legislation, Taxes, Laterals, Financing, Construction, Drains, Ditches, Pipes, Maintenance costs, Replacement costs, Planning, Public benefits, Administrative decisions, Maintenance, Administrative agencies.

Defendant drainage district filed a petition in county court stating that, in order to preserve and maintain the drainage ditches and drainage system constructed by them, it was necessary to issue bonds. The proceeds from the bonds would be used to complete the work of improving, cleaning out, deepening and widening its drains, constructing culverts and openings where needed, and performing other necessary maintenance work. In order to pay the principal and interest of these bonds, it was necessary that a tax be levied on the assessed benefits of the district. Without giving any notice of a hearing on the petition, as required by statute, the county court entered an order granting the petition. Plaintiff landowners of the district appealed to the circuit court which affirmed the county court order. The supreme court reversed, stating that if additional laterals are to be constructed, or if an additional assessments of benefits is required to pay for such improvements, the statutory requirements for notice to the property owner must be observed. (Barnett-Florida)
W70-08782

OLSON V PRESTON STREET WATER DIST NO 1 (PURCHASE OF WATER PLANT OUTSIDE DISTRICT).
291 Ky 155, 163 SW2d 307-309 (1942).

Descriptors: *Kentucky, *Public utility districts, *Cities, *Municipal water, Local governments, Economics, Public utilities, Water works, Judicial decisions, Legal aspects, Planning, Water supply, Water utilization, Costs, Water costs, Water demand, Legal aspects, Legislation, Supervisory control (Power), Administrative agencies, Administrative decisions.

Plaintiff, as a taxpayer and resident in defendant water district, sued to enjoin the commissioners of the district from putting into effect a plan to buy a water plant which would supply members of the district. The plant was situated partly within and partly outside of defendant district. The court gave judgment for plaintiff, holding that state statute prohibited the district from purchasing a water supply plant that was not located wholly within the district's boundaries. The court acknowledged the many benefits purchase of the existing plant would provide, such as increased water pressure, more efficient circulation, assured sales and reduced insurance rates, and suggested that the district follow prescribed procedures to extend its boundaries. (Hubener-Florida)
W70-08783

NASHVILLE WATER CO V DUNLAP (EMINENT DOMAIN AS AN INDICATION OF PUBLIC PURPOSE).
138 SW2d 424-428 (Tenn 1940).

Descriptors: *Tennessee, *Eminent domain, *Administrative agencies, *Regulation, Administrative decisions, Community development, Condemnation, Contracts, Judicial decisions, Legal aspects, Legislation, Local governments, Public rights, Public benefits, Relative rights, State governments, Taxes, Public utilities, Water works.
Identifiers: *Public purpose.

Defendant, commissioner of the Public Utilities Commission, attempted to regulate plaintiff water company and to assess it for tax purposes. A state statute authorized defendant to so regulate and tax water companies as public utilities. Despite its state charter, which conferred upon it, among other things, the power of eminent domain, plaintiff contended that it was not a water company within the meaning of the statue because it acquired its pipelines from private individuals and corporations which had previously operated as real estate development organizations. The court held that the acceptance of a charter conferring powers of eminent domain is a profession of public purpose. Plaintiff's acceptance of the charter was a voluntary act, and as long as it operated under such charter, it could not claim that its properties were

not affected by a public use. Plaintiff was accordingly found to be a public water company within the meaning of the statue, and thus subject to regulation and taxation by defendant. (Clarke-Florida)
W70-08784

GRAVES V LITTLE TARKIO DRAINAGE DIST NO 1 (FINANCING RECLAMATION PROJECTS).

134 SW2d 70-81 (Mo 1939).

Descriptors: *Missouri, *Administrative decisions, *Drainage districts, *Land reclamation, Boundaries (Property), Community development, Legal aspects, Judicial decisions, Legislation, Proprietary power, Public benefits, Relative rights, Right-of-way, State governments, Water transfer, Taxes, Controlled drainage, Surface drainage, Ditches, Drainage systems, Flood control, Laterals, River systems, Levees, Dikes, Financing

Pursuant to a reclamation plan and statutory authority, defendant drainage district constructed several large drainage ditches and appurtenant works. Between 1910 and 1937 defendant substantially repaired and enlarged the works. The construction was paid for by warrants issued to contractors. The warrants were financed by several levies of a maintenance tax which the district supervisors were statutorily authorized to collect from landowners within the district for the purpose of repairing and improving the works. In seeking to enjoin the collection of the maintenance tax, plaintiff landowners claimed that the improvements to the works were not within the original plan of reclamation and, in fact, constituted the construction of a completely new drainage system. Defendant admitted that the improvements were more than contemplated by the original plan, but claimed that plaintiffs had had full knowledge of the construction of the system as it existed and had benefited from it for twenty-seven years. Defendant pleaded laches and estoppel. The court granted defendant's plea of laches. The court further stated that provisions of drainage acts should be construed broadly and liberally. The court found that most of the construction performed after 1910 was within the powers of the district supervisors to maintain and protect the plan for reclamation. Plantiff's injunction was denied. (Clarke-Florida)
W70-08785

MIDDENDORF V JAMESON (RIGHT TO ISSUE REFUNDING BONDS).
265 Ky 111, 95 SW2d 1057-1059 (1936)

Descriptors: *Kentucky, *Public utility districts, *Depression, *Assessments, Economics, Local governments, Real property, Public utilities, Water works, Judicial decisions, Legal aspects, Financing, Cities, Planning, Income, Interest, Land tenure, Water users, Water supply, Cost repayment, Debt.

Commissioners of a water district issued and sold assessment bonds to pay for the acquisition of a water plant. The bonds were payable solely out of the assessments against property in the water district. Because of the financial depression of the 1930's, the owners in the district were unable to pay assessments. This action was instituted for a declaration of the right of the board of commissioners to issue and sell refunding bonds pursuant to a state statute. The court, interpreting the statute, held that the water district was not subject to the jurisdiction of the Kentucky Public Service Commission and was empowered to issue refunding bonds payable by assessments on property within the district. (Hubener-Florida)
W70-08786

HOGAN V COWART (DUTY NOT TO OBSTRUCT DRAINAGE THROUGH DITCH ACQUIRED BY EASEMENT).
184 SE 884-886 (Ga 1936)

Descriptors: *Georgia, *Obstruction to flow, *Prescriptive rights, *Easements, Real property, Damages, Remedies, Judicial decisions, Legal aspects, Drainage, Drainage practices, Drainage water, Ditches, Surface waters, Excess water (Soils), Water injury, Cultivation, Flow, Relative rights, Repulsion (Legal aspects), Land tenure.
Identifiers: *Trespass (Continuing).

Plaintiff and defendant were conveyed adjoining tracts of land from a common owner. A drainage ditch extended from plaintiff's property through the adjoining land of defendant. For more than twenty years plaintiff and her predecessor in title had continuously used the ditch to drain water from plaintiff's land. By plowing over and filling it, defendant obstructed the flow of water through the ditch, thus preventing drainage of plaintiff's property. Plaintiff sought injunctive relief to prevent future obstruction of the ditch, and sought damages to cultivation caused by such obstruction. As plaintiff's adverse use of the ditch was for more than twenty years, the court found that she had acquired an easement by prescription in such ditch. In granting the injunction and damages, the court held that defendant had committed a continuing trespass in closing the ditch and was therefore liable to the extent of the injuries which plaintiff incurred as a result of the obstruction to flow. (Finman-Florida)
W70-08787

LEGISLATIVE DISCOURAGEMENT OF MAINE'S MARINE INDUSTRIAL GROWTH.

Maine Law Review, Vol 22, 1970. p 265-282.

Descriptors: *Maine, *Harvesting of algae, *Marine algae, *Legislation, Aquatic algae, Ecology, Aquatic plants, Aquatic life, Marine plants, Natural resources, Conservation, Submerged Lands Act, Oceans, Coasts, Beds, Submerged plants, Harvesting, Research and development, Aquatic environment, Economics, Environment.

Existing law in Maine as to the control of the cultivation, conservation, and harvesting of marine algae is embodied in its Research and Development Statute. Under this statute only a limited portion of the state's ocean floor is subject to state control over the utilization of marine algae. The vast majority of the state's ocean floor is unaffected by the statute. The author asserts that this statute is representative of Maine's inadequate and piecemeal treatment in the area of marine resources control. The author attacks Maine's laws as unprogressive and insufficient to recognize the state's responsibility in the area of developing, controlling, and utilizing the resources of its ocean floor. The author calls for a comprehensive and unified program in the entire area of marine resources so as to insure a well-organized and complete development of Maine's ocean resources. (Snow-Florida)
W70-08788

HUEY V STATE (NO RIGHT TO DAMAGES FOR DIVERSION OF UNDERGROUND WATER SUPPLY).
170 Misc 677, 11 NYS2d 195-198 (Ct Cl 1939).

Descriptors: *New York, *Excavation, *Underground streams, *Diversion, Water wells, Obstruction to flow, Foundations, Wells, Land, Acreage, State governments, Bridge construction, Highways, Piers, Water supply, Water demand, Water sources, Livestock, Damages, Appropriation, Right-of-way, Legal aspects, Judicial decisions, Surface waters.

Plaintiff landowner conveyed several acres of land to county authorities who provided this land to defendant state for defendant's construction of a highway. Defendant began excavating for the foundation of a bridge pier, whereupon its contractor struck quicksand and an underground stream. Plaintiff's two wells, which were located one hundred feet and two hundred fifty feet respectively from defendant's excavating operation, ran dry. In a suit for damages, plaintiff claimed the destructio of his two wells amounted to an additional ap propriation of his property and was the direct resu of defendant's construction work. Defendant mair tained its contractor was not negligent nor did h have any knowledge of an underground strean The court held plaintiff could not recover damage to his property, as defendant only performed i duly authorized work on its own right of wa Moreover, the court noted that state law denied lia bility for the diversion of underground wate where there was no adverse effect on surfac waters nearby. (Finman-Florida)
W70-08790

BD OF EDUC V TOWN OF N HEMPSTEA (LIABILITY FOR DIVERSION OF SURFAC WATERS).
259 App Div 732, 18 NYS2d 433-434 (Sup C 1940).

Descriptors: *New York, *Drainage systems *Drainage engineering, Abatement, Drainage ef fects, Remedies, Drainage practices, Drainag water, Drainage, Cities, Construction, Surfac waters, Culverts, State governments, Legal aspects Judicial decisions, Damages, Water injury, Con trolled drainage, Operations, Local governments Surface runoff.
Identifiers: *Nuisance (Continuing), *Trespas (Water).

Defendant construction company built a drainag system for defendant town pursuant to the con struction of city streets. Plaintiff school district al leged that the drainage system was a continuin nuisance, which caused surface waters to accumu late and pass over its lands. Plaintiff brought actio to abate the alleged nuisance and to enjoi trespassing upon its lands. Defendants maintaine that the waters which passed over plaintiff's land had come from a culvert constructed by the state The court stated that even if defendant construc tion company had created a nuisance from whic plaintiff had suffered, it was not liable since it ha dedicated the streets containing the drainag system to defendant town, and such dedication di not carry with it any warranties or inference tha the drainage system was to be continued in any par ticular form. Moreover, the court noted evidenc which showed that the instrumentality from whic waters were cast upon plaintiff's lands was con tructed and controlled by the state. Therefore plaintiff's injunction was denied. (Finman-Florida) W70-08791

BONDY V UTAH CONSTR CO (TUNNEL CON STRUCTION INTERFERING WITH UN DERGROUND STREAMFLOW).

23 NYS2d 125-126 (Sup Ct 1940).

Descriptors: *New York, *Underground struc tures, *Water wells, *Tunnel construction wate demand, Underground streams, Damages, Con tracts, Condemnation, Cities, Legal aspects, Judi cial decisions, Construction, Easements, Land Water supply, Water users, Water shortage Streams, Streamflow, Water injury, Tunnels, Tun neling, Remedies, Subsurface waters.
Identifiers: *Injunction (Temporary).

In order to construct a tunnel, the City of Nev York obtained a tunnel easement in condemnatio proceedings to certain subterranean lands. Defen dant contracted with the city to build such tunnel After commencement of construction by defen dant, wells on plaintiff's lands ran dry. Plaintiff were deprived of water for necessary household purposes, and their buildings were subsequentl rendered uninhabitable. Plaintiffs claimed that de fendant's activities in connection with the con struction of the tunnel caused interference with th subterranean streams of water which fed their well and, therefore, sought a temporary injunctio requiring defendant to immediately supply plain tiffs with water. The court stated that defendan

ıd done nothing except construct a tunnel accord-
g to its contract and pursuant to the right of the
ty, which was obtained in condemnation
roceedings. The rule being well-settled that the in-
rference with subterranean veins of water as the
sult of a lawful use of one's own property was
ımnum absque injuria and could not become the
ound of an action, the court held that plaintiffs
ere not entitled to a temporary injunction. (Fin-
an-Florida)
70-08792

**ENNITO V TOWN OF WAYLAND (LIABILI-
Y FOR DAMAGES RESULTING FROM THE
LTERATION OF SURFACE DRAINAGE).**

NYS2d 654-675 (Sup Ct 1943).

escriptors: *New York, *Roads, *Cities, *Sur-
ce drainage, Drainage, Drains, Muck soils, Judi-
al decisions, Legal aspects, Reasonable use, Field
ops, Flood control, Overflow, Farm manage-
ent, Crops, Hydrographs, Drainage practices,
rface waters, Streams, Ditches, Drainage en-
neering, Outlets, Culverts, Pipes, Streamflow,
rface runoff, Storms, Alteration of flow, Natural
ow.

aintiff owned farm lands adjacent to defendant
ty's roadway. Prior to defendant's widening and
rfacing the road, there were adequate means of
ainage for excess surface waters that resulted
om heavy rains and from the resulting overflow of
stream which bounded plaintiff's lands. Plaintiff
leged that defendant, when improving the road-
ay, diverted the excess surface water from the
urse of its natural flow by constructing drains
ıd culverts to allow adequate drainage for the
ad. Plaintiff further alleged that defendant
egligently constructed these drainage facilities
ıd as a result caused the diverted waters to be
scharged upon his land, causing damage to the
e and his crops. Defendant contended that the
orm which caused the complained of damages
as unprecendented and constituted an 'Act of
od.' The court, in holding for plaintiff, stated that
ny natural or normal alteration of the surface of
ne's land, resulting in the casting of surface waters
pon the land of another through drains or other
rtificial channels, is a trespass for which damages
ill lie. (Barnett-Florida)
/70-08793

**AYLOR V STATE (RIGHT TO DIMINUTION
F RENTAL VALUE FOR FLOOD DAMAGES).**
9 NYS2d 189-190 (Ct Cl 1946).

escriptors: *New York, *Damages, *Flood
amage, *Rent, Floodwater, Flood control, Flood-
ıg, Lakes, Land, State governments, Legal
spects, Judicial decisions, Buildings, Reservoirs,
osts, Replacement costs, Value, Diversion,
Vatercourses (Legal), Water injury, Surface
aters, Percolation, Real property.

laintiff landowner sought damages to his land and
uildings due to floodwaters from a lake. There was
o question as to the liability of defendant for the
ost of restoration of plaintiff's premises. The
isputed issue was whether or not plaintiff could
eceive damages for the loss of rental of two cot-
ages as a result of such flooding. The court held
hat plaintiff was entitled to damages due to the loss
f rental of the two cottages since they had been
ustomarily used for rental purposes. Moreover,
he court stated that as a general rule, where lands
re flooded by the wrongful diversion of a water
ourse, by collection of surface waters on premises
r by percolation of waters from a reservoir,
lamages are measured by the diminution in the
ınable or rental value of the land to the time of the
ommencement of the action. (Finman-Florida)
W70-08794

TENNESSEE A AND G RY V CARDON (DUTY TO MAINTAIN ADEQUATE DRAINAGE AFTER CONSTRUCTION OF DITCHES).
7 Div 272, 177 So 171-172 (Ala 1937).

Descriptors: *Alabama, *Diversion, *Obstruction to flow, *Surface drainage, Embankments, Erection, Construction, Ditches, Right-of-way, Surface waters, Properties, Damages, Legal aspects, Judicial decisions, Maintenance, Drainage systems, Crops, Overflow, Overland flow, Remedies, Drainage effects, Railroads, Maintenance.
Identifiers: *Railroad roadbeds.

Defendant railroad constructed a roadbed on a right-of-way adjacent to plaintiff's upper lands. In constructing the roadbed, defendant erected embankments but also dug ditches in order to keep surface waters from backing up onto plaintiff's lands. When kept clear of obstructions, the ditches adequately drained surface waters. They became clogged, however, and as a result, surface waters were diverted back upon plaintiff's property, causing damages to his lands and destruction of his crops. Plaintiff contended that after he gave notice of such condition, defendant allowed it to remain. Therefore, plaintiff brought an action for damages. Defendant denied its liability for damages to plaintiff. The court stated that in acquiring the right-of-way, defendant secured certain rights but also assumed corresponding burdens. The court held it was defendant's duty to construct, as well as maintain, a drainage system adequate to allow free flowage of surface waters and to prevent the accumulation of such surface waters upon plaintiff's lands. Since it had failed to execute these duties, defendant was held to be liable for plaintiff's damages. (Finman-Florida)
W70-08795

LEHNER V KOZLOWSKI (RIGHT TO RELOCATE DRAINAGE DITCH ACROSS ADJOINING LAND).

245 Wis 262, 13 NW2d 910-913 (1944).

Descriptors: *Wisconsin, *Obstruction to flow, *Tile drains, *Drainage systems, Relocation, Contracts, Drains, Ditches, Legal aspects, Judicial decisions, Remedies, Drainage, Drainage effects, Construction, Marshes, Overflow, Surface waters, Agriculture, Culverts, Real property, Flow, Flow control, Easements, Relative rights.
Identifiers: *Trespass (Land), Injunction.

With the hope of redeeming some of his marshland for agricultural purposes, plaintiff constructed a tile drain pursuant to a written contract with defendant's predecessor in title. The drain extended from plaintiff's land across the property owned by defendant at the time of trial. In an effort to improve the drainage of surface waters, plaintiff subsequently constructed a new, open ditch across defendant's land without defendant's consent. Such construction caused surface waters to overflow onto a road running through defendant's land, thereby making such road unusable. Defendant constructed a culvert in order to maintain the road in a usable condition, and the culvert caused an obstruction to the flow of waters through the new ditch. As a consequence, plaintiff commenced suit to enjoin the obstruction. In constructing the new ditch, plaintiff contended he was acting within the scope of the written contract, which granted plaintiff an easement for the purpose of establishing a drainage system across defendant's land. The appellate court, in affirming the lower court decision for defendant, held that the contract had created a drainage easement. However, plaintiff was bound by his earlier choice of atile drain and could not construct an open ditch in a new location. In so doing, plaintiff trespassed on defendant's land. (Finman-Florida)
W70-08796

LAND MANAGEMENT IN MUNICIPAL WATERSHEDS,
W. W. Jeffrey, and B. C. Goodell.
American Water Works Association Journal, Vol 62, june 1970, p 380-384.

Descriptors: *Forest management, *Watershed management, *Water yield, *Land management, Reservoirs, Flooding, Clear-cutting, Vegetation effects, Recreation, Hydrologic cycle, Habitat improvement, Municipal water, Water pollution, Multiple-purpose projects, Water conservation, Public health, Water quality, Water pollution sources, Flow augmentation, Land management, Wildlife management, Lumbering, Sediment control, Watersheds (Basins), Reforestation, Evapotranspiration control.
Identifiers: *Catchments basins, *Logging.

With the need for more and better planning of watershed areas, the concept of multiple use land management has become necessary. The purpose of this concept is to combine multiple uses that are compatible on the same land areas. Emphasis herein is placed on land use in forested municipal watersheds. Timber resources are highly compatible with water production of high quality and adequate quantity. Deforestation of a watershed, in a well-planned scheme, can be beneficial by increasing the water yield of that area. The removal of trees stops the evapotranspiration process and removes the major interceptors of rain and snow, thus allowing a greater water yield. Proper synchronization of deforestation can also improve the stream-flow regime and allow for proper forest conservation as well. A major factor to guard against in such procedures, however, is the impairment of water quality by the soil disturbances associated with logging. Other safeguards against pollution sources such as herbicides, fertilizers and machinery wastes must be utilized. The recreational use of watersheds is found to be compatible with the objective of quality water production and should be prohibited. Selected experiences in timber resource management on municipal watersheds are also examined. (Barnett-Florida)
W70-08797

STRUCTURE OF PUBLICLY-OWNED WATER UTILITIES,
For primary bibliographic entry see Field 06C.
W70-08799

PLANNING FOR WATER QUALITY EMERGENCIES,
T. F. Craft.
American Water Works Association Journal, Vol 62, March 1970, p 181-184.

Descriptors: *Future planning (Projected), *Water pollution control, *Water management (Applied), *Water supply, Planning, Decision making, Impaired water quality, Water demand, Fluctuation, Flow control, Disasters, Watersheds (Basins), Surveys, Waste disposal, Treatment facilities, Pipelines, Water pollution, Farm wastes, Radioactive wastes, Watershed management, Water purification, Coordination, Pollution abatement, Water utilization.

Planning is essential to any type of endeavor, especially in the area of water quality control. Immediate steps should be taken by responsible persons to prepare for disasters and other emergencies which might affect the available water supply. Floods, upstream pollution and spillage of pollutants into reservoirs are examples of these items. To initiate a water quality control program, a comprehensive survey of the watershed concerned should be undertaken to pinpoint possible trouble spots. Treatment plants, pipelines, petroleum tanks and farm chemical concentrations are among items which should be included in such a survey. Steps to combat pollution from each potential source should be planned in detail, and materials adequate for any emergency should be stockpiled. Officials must be trained to recognize an emergency when

one occurs. Continual coordination between responsible persons is necessary to insure the effectiveness of any plan. (Caldwell-Florida)
W70-08800

AN ENVIRONMENTAL COMMON LAW FOR MICHIGAN,
Joseph L. Sax.
L Quadrrangle Notes, Vol 14, Spring, 1970, p 27-32.

Descriptors: *Michigan, *Ecology, *Remedies, *Legislation, Environmental effects, Local governments, State governments, Administrative agencies, Legal aspects, Environment, Public health, Public rights, Relative rights, Public benefits, Natural resources, Resource development, Economics, Jurisdiction, Political aspects, Adjudication procedure.

House Bill 3055, recently introduced into the Michigan state legislature, is based on a model environmental quality bill drafted by Professor Sax. The bill authorizes the Attorney General, local governments and private citizens to go into court and challenge activities which infringe upon the right of the public to a clean, healthy and attractive environment. Such a bill would serve as the basis for the creation of a body of environmental common law more flexible, innovative and responsive than existing agencies and legal remedies. Too often agencies become single-minded about the scope of their functions, and citizens are thwarted in their legal efforts either by lack of standing to sue or by judicial deference to the agencies. The proposed bill can further expand the public suit concept whereby private citizens sue on behalf of the public to enjoin public nuisances. Heretofore, such suits have been directed largely against such targets as prostitution or gambling establishments. The right to such a suit should be available to a party who can show a reasonable likelihood of an adverse effect of some particular activity on the state's resources or environment. (Hubener-Florida)
W70-08801

AIR AND WATER POLLUTION: WHAT TO DO WHILE WAITING FOR WASHINGTON,
John C. Esposito.
Harv Civ Rights - Civ Lib L Rev, Vol 5, p 32-52, 1970. 90 ref.

Descriptors: *Water pollution, *Air pollution, *Pollution abatement, *Water pollution control, Impaired water quality, Water pollution treatment, Water pollution sources, Treatment facilities, Water pollution effects, Legal aspects, Industrial wastes, Costs, Pollutant identification, Judicial decisions, Administrative agencies, Capital costs, Public rights, Public benefits, Environmental engineering. Environmental sanitation, Governments, Regulation, Remedies.

Efforts must be made to expand judicial remedies for air and water pollution because corrective legislation is unlikely to be forthcoming in the near future. Pollution abatement is unprofitable for corporate poluters, and so such a program must be forced on them by external pressures. Private nuisance or trespass suits brought as class actions may become effective deterrents to polluters due to the large amounts of total claims. Some cases have held that failure to keep up with recent developments in pollution control devices rendered the polluter liable for punitive damages. Using a product liability theory against producers of pollution-generating items such as automobiles might yield results. Stockholder suits also promise to be effective. Courts could take a leading role in abating pollution by closely scrutinizing administrative action and issuing mandamus and injunction writs to force necessary action. It could be argued that a constitutional right to be free from pollution exists, based on the 9th amendment and the due process clause of the 14th amendment. Traditional tendencies of courts to favor business interests would militate against these arguments, however. (Caldwell-Florida)
W70-08802

EFFLUENT CHARGES AND THE INDUSTRIAL WATER POLLUTION PROBLEM,
For primary bibliographic entry see Field 05B.
W70-08803

THE RIPARIAN RIGHTS DOCTRINE IN SOUTH CAROLINA,
Edward P. Guerard, Jr.
South Carolina Law Review, Vol 21, 1969, p 757-770. 57 ref.

Descriptors: *South Carolina, *Riparian rights, *Reasonable use, *Water rights, Water policy, Ownership of beds, Prior appropriation, Prescriptive rights, Relative rights, Riparian rights, Riparian land, Riparian waters, Water utilization, Natural flow doctrine, Competing uses, Water allocation (Policy), Water resources development, Water supply, Natural watercourses, Watercourses (Legal), Water demand, Navigable waters, Water pollution, Non-navigable waters.

The doctrine of riparian rights, as adopted by the South Carolina courts, gives an inherent right to the flow of a stream in its natural course to the owner of lands bounded or traversed by such stream. Riparian rights of a proprietor exist only as to natural watercourses, a course which has defined banks and beds, notwithstanding whether or not it may at times be dry. If a natural watercourse does exist so as to invoke the applicability of the riparian rights doctrine, the extent of these rights depends on whether the stream is navigable or non-navigable, which in turn determines the ownership of the beds of such waters. Beds of tidal navigable watercourses are property of the state subject to the rights of the federal government. The ownership of the beds of non-navigable and navigable non-tidal waters lies in the owners of the adjoining properties. The riparian doctrine is further qualified by the reasonable use doctrine which determines the extent of the right of a riparian to use the water. Each riparian has equal right to make reasonable use of water subject to equal rights of other riparians to make a reasonable use. (Snow-Florida)
W70-08804

THE LIMITS OF CONTINENTAL SHELF JURISDICTION: SOME POSSIBLE IMPLICATIONS OF THE NORTH SEA CASE JUDGMENT,
R. Y. Jennings.
International and Comparative Law Quarterly, Vol 18, Oct 1969, p 819-832. 28 ref.

Descriptors: *Continental shelf, *International law, *Ownership of beds, *Judicial decisions, International waters, Beds under water, Continental margin, United Nations, Legal aspects, Conferences, International commissions, Exploitation, Boundary disputes, Boundaries (Property), Adjudication procedure, Continental slope, Geology, Geomorphology, Oceans, Topography, Marine geology.

The North Sea Case has implications concerning fundamental issues of the character and limits of continental shelf jurisdiction. While the Geneva Convention on the Continental Shelf purported to define the limits of the shelf as occurring at a depth of 200 meters, general principles of international law should provide more useful definitions. The case, which resolved a dispute among several European nations and Britain over ownership of the North Sea bed, did not concern itself with general international law principles, but affects them nonetheless. Traditionally, continental shelf jurisdiction has been described as an inalienable appurtenance of the coastal state's sovereignty over its land territory. Geomorphological considerations, that is, the physical identity between land and continental shelf, are of primary importance in determining the extent of the shelf. While the shelf must be adjacent to the coast, absolute proximity is not a factor in determining the extent of the jurisdiction over the shelf. In light of the North Sea Case, the 200 meter test must be considered as holding that a coastal state's jurisdiction over the shelf extends to a depth of 200 meters, and as far beyond that as it can be shown that the shelf is a natural prolongation of the land. (Caldwell-Florida)
W70-08805

INTERNATIONAL PRACTICE REGARDING TRADITIONAL FISHING PRIVILEGES OF FOREIGN FISHERMEN IN ZONES OF EXTENDED MARITIME JURISDICTION,
David W. Windley.
American Journal of International Law, Vol 63, 1969, p 49-503. 51 ref.

Descriptors: *International law, *Law of the sea, *Foreign waters, *Commercial fishing, International waters, Legal aspects, Continental shelf, Oceans, Aquatic life, Marine fisheries, Legislation, Atlantic Ocean, Treaties, Trawling, Fisheries Regulation, Crabs, Tariff, Jurisdiction, Political aspects, Fishing, Fish, Relative rights.
Identifiers: *Comity.

In recent years many nations have for various purposes extended their sovereignty or exclusive control beyond the three mile territorial sea traditionally claimed. Often the purpose is to preserve exclusive fishing rights for the coastal state or to regulate the activities of foreign fishermen. The displaced fishermen have no privilege beyond what international comity can preserve for them. Thus, at times, coastal nations recognize each other's traditional or historic fishing rights on a basis of reciprocity. In other cases governments do not recognize historic rights but, nevertheless, agree to fish in each other's coastal water pursuant to mutually acceptable provisions. The United States maintains exclusive fishing rights in a nine mile zone contiguous to its three mile territorial sea. However, it recognizes traditional fishing rights in the contiguous zone. The United States has made agreements with Russia, Japan and Mexico controlling traditional fishing rights and exploitation of the continental shelf. Some South American nations, to control foreign fishing, claim sole sovereignty over waters up to 200 miles from their coast. Also discussed are other agreements on fishing rights. They involve such countries as Russia, Iceland, Japan, South Africa, Australia and New Zealand. (Hubener-Florida)
W70-08806

INTERNATIONAL LAW AND 'THE INTERESTS': THE LAW OF THE SEABED,
Louis Henkin.
American Journal of International Law, Vol 63, 1969, p 504-510. 11 ref.

Descriptors: *Appropriation, *International law, *Jurisdiction, *Ownership of beds, Boundaries (Property), Beds under water, Boundary disputes, Equitable apportionment, Federal government, Federal jurisdiction, Governments, Legal aspects, Legislation, Political aspects, Submerged Lands Act, Treaties, International waters, Foreign waters, Oil industry, Preferences (Water rights), Priorities, Oceans, Continental shelf, Continental slope.
Identifiers: *Mineral rights.

One of the least settled areas of international law concerns coastal nations' rights to the seabed. The basic legal issues are simply stated: how far do, and should, the exclusive rights of coastal states extend, and what legal regime should govern exploitation beyond the limits of national jurisdiction. The United States has been the first to consider these questions, but it has reached no concrete conclusions. Different interests have pressed for different official positions. The National Petroleum Council advocated a position that the legal continental shelf should extend to the full limit of the continental

nd mass. If all coastal nations adopted this policy, ıe quarter of the total ocean bed would be ap-ropriated. The International Law Commission and e International Court of Justice would severely nit coastal boundaries. One major concern is that e accepted extension of national jurisdiction for ıe purpose tends to become jurisdiction for all rposes. A presidential commission has recently roposed an 'intermediate zone' in which the astal state would have the exclusive right to ex-oit the resources, subject to the regime that is to vern all the seabed beyond national jurisdiction. Clarke-Florida)
70-08807

TATE TERRITORY--TERRITORIAL ATERS--ACQUISITION OF TERRITORIAL OVEREIGNTY--TITLE BY DISCOVERY--ITLE TO CONTINENTAL SHELF--JURISDIC-ION OVER REEFS AS COMPARED WITH LANDS--PRIVATE PROPRIETARY CLAIMS O REEFS--OUTER CONTINENTAL SHELF ANDS ACT, 1953--THE LAW OF THE UNITED TATES.

merican Journal of International Law, Vol 63, 969, p 642-644. 8 ref.

escriptors: *Federal government, *Federal ju-sdiction, *Ownership of beds, *Continental shelf, oundaries (Property), Boundary disputes, Com-unity development, Jurisdiction, Legal aspects, dicial decisions, Proprietary power, Recreation, elative rights, Unappropriated water, Navigable aters, Reefs, Political aspects, Construction, ecreation facilities, Rivers and Harbors Act.
entifiers: *Outer Continental Shelf Lands Act.

efendants wished to commercially develop as urist attractions two reefs located 4 1/2 miles outheast of Florida. Plaintiff United States notified efendants: (1) that they were precluded from un-rtaking any construction in the navigable waters the United States without the approval of the epartment of the Army; (2) that the Depart-ent's authority extended to fixed structures cated upon the Outer Continental Shelf; and (3) at the reefs were located within the Outer Con-ental Shelf. Nevertheless, defendants began con-ruction. Plaintiff brought suit for trespass on overnment property and for violation of section 0 of the Rivers and Harbors Act of 1899 and sec-on 4 (f) of the Outer Continental Shelf Lands Act f 1953, both of which required authorization of ıe Department of the Army before artificial struc-ures could be erected on the outer continental elf. The court held that the United States did not old title to the continental shelf, only jurisdiction f the seabed. Consequently, there was no trespass, ut defendants clearly violated the statutes since ıe reefs were found to be part of the seabed rather an islands. (Clarke-Florida)
70-08808

NITED STATES V LOUISIANA (LOUISIANA OUNDARY CASE).

merican Journal of International Law, Vol 63, 969, p 832 837. 23 ref.

escriptors: *Louisiana, *Boundary disputes, Submerged Lands Act, *Federal jurisdiction, In-ernational law, Boundaries (Property), Federal overnment, Legal aspects, Legislation, Ownership f beds, Relative tights, State governments, State risdiction, Third party effect, International aters, Beds, Governments, Channels, Channel im-rovement, Bays, Islands, High water mark, Low ater mark, Tidal waters, Tidal effects, Gulf of lexico.
dentifiers: *Seabeds.

n United States v Louisiana, 394 U. S. 11 (1969), decree was sought to determine the line marking he seaward limit of the inland waters of Louisiana. The United States contended that the Submerged ands Act of 1953 had given to Louisiana, by quit claim deed from the United States, lands extending three miles from the state's coastline into the Gulf of Mexico. Louisiana contended that this Act did not apply to it since the boundaries of its inland waters had already been delineated by the Submerged Lands Act of 1895 and since the inland water line so delineated was a historic boundary. The Supreme Court distinguished the two Acts in that the 1895 Act was concerned with navigational waters, whereas the 1953 Act pertained to boundary matters. As to Louisiana's claim to the historic boundaries, the Court held that historic title can be claimed only when the coastal nation has traditionally asserted and maintained dominion with the acquiescence of foreign nations. In connection with this case, the Court further held that: (1) dredged channels do not constitute inland waters; (2) low tide elevations are part of the coastline; (3) a bay must be at least a semi-circle, and islands can be included as part thereof; and (4) islands realistically part of the coast can be headlands to a bay. (Clarke-Florida)
W70-08809

REFLECTIONS ON RIPARIANISM,
T. E. Lauer.
Missouri Law Review, Vol 35, 1970, p 1-25.

Descriptors: *Social aspects, *Riparian rights, *Competing uses, *Watercourses (Legal), Civil law, Industries, Judicial decisions, Legal aspects, Natural flow doctrine, Prior appropriation, Water tights, Relative rights, Municipal water, Reasonable use, Obstruction to flow, Water pollution, Water utilization, Water resources development, Governments, Water resources, Permits, Regulation, economics, Resource allocation, Legislation.

'Reflections on Riparianism' suggests possible legal solutions to the rapidly deteriorating water situation in the United States. It discusses in detail the legal technicalities of riparianism, its virtues and its drawbacks, and it explores alternatives to the riparian system including prior appropriation, the permit system, economic determinism, quantifying the water right, water development and a modified riparian system. The author concludes that an updated and modernized riparian system would be the best legal means for pre-serving and equitably distributing present and future water resources. (Clarke-Florida)
W70-08810

MODIFICATION OF THE RIPARIAN THEORY AND DUE PROCESS IN MISSOURI,
For primary bibliographic entry see Field 04A.
W70-08811

POLLUTION CONTROL: WHY HAS IT FAILED,
For primary bibliographic entry see Field 05C.
W70-08812

ZONING THE FLOOD PLAINS OF OHIO.
For primary bibliographic entry see Field 04A.
W70-08813

TERRITORIAL SEAS - 3000 YEAR OLD QUESTION.
Journal of Air Law and Commerce, Vol 36, 1970, p 73-104.

Descriptors: *International law, *International waters, *Law of the sea, *Jurisdiction, Oceans, Admiralty, International commissions, Navigation, Legal aspects, Relative rights, Foreign waters, Treaties, Ships, History, United Nations, Bays, Inland waterways, Water rights, Political aspects, Governments, Prescriptive rights, Judicial decisions, Commercial fishing.

Territorial waters, as opposed to international or inland waters, have long been a source of friction in international relations. Historically, the right of all nations to the high seas has been recognized. Several rules concerning jurisdiction over territorial seas have developed, the most common being the three mile 'cannon shot' rule. Difficulties in drawing the 'base line' for the delimitation of the territorial sea arise where states have rough, deeply indented coastlines, and in cases of islands or large bays or gulfs. The extent of jurisdiction over territorial waters has been historically conceived of as actual ownership, subject to the right to innocent passage of foreign vessels. Presently, the plethora of limits claimed by various nations causes much international dispute. Most nations claim three mile limits, but some claim four, twelve, and even two-hundred miles. Several international conferences have failed to solve the problem. Much legal and political turmoil could be avoided by an international agreement on some standard, such as a six mile limit with a six mile contiquous zone where the coastal state would have exclusive fishing and exploitation rights. (Caldwell-Florida)
W70-08814

THE CONSTITUTIONAL SANCTITY OF A PROPERTY INTEREST IN A RIPARIAN RIGHT.
Washington University Law Quarterly, Vol 1969, p 327-338.

Descriptors: *Riparian rights, *Permits, *Regulation, *Administrative agencies, Compensation, Prior appropriation, Control, Legal aspects, Legislation, Competing uses, Water utilization, Reasonable use, Water allocation (Policy), Water rights, Administration, Economics, Non-structural alternatives, Public benefits, Public rights, Usufructuary right, Water users.

As a water supply sufficiently abundant for all needs has disappeared in the Eastern United States, the justifications for the traditional riparian doctrine have also decreased. State legislation has been widely proposed to meet the increasing need for administrative supervision of all future water allocation. Much proposed legislation, based on the Model Water Use Act, changes the riparian system by the creation of a permit system. Existing uses of water would be allowed to continue, but future uses could only be instituted by obtaining a permit. Broad discretion would be accorded agencies in establishing priorities in the issuance of permits. The permits should be of a fixed duration sufficient to provide investment security. The agency would have power to issue a permit for water use without regard to common law restrictions on the riparian's use. Modifications of riparian uses in the nature of regulations should be permitted under the police power with no compensation required. If the modification amounted to a taking of property, compensation would be required to satisfy due process. The historical test, however, has required compensation for any diminution of value of a property right caused by government regulations. (Hubener-Florida)
W70-08815

NARAMORE V STATE (DAMAGES FOR NEGLIGENT OPERATION OF BARGE CANAL).
285 NY 80, 32 NE2d 800-802 (1941).

Descriptors: *New York, *Dams, *Damages, *New York State Barge Canal, Canals, Channels, Engineering structures, Ice, Melting, Sluices, Structures, Regulation, Surface waters, Damsites, Mill dams, Barriers, Judicial decisions, Legal aspects, State governments, Discharge (Water), Open channels.

Plaintiff land owner brought action against defendant state for damages allegedly arising from the negligent operation of a barge canal. Defendant had opened the sluice gates at two points on the canal and thereby raised the level of water in a creek which flowed across plaintiff's land. Plaintiff had constructed a dam on the creek for the operation of a flour mill. Ice had formed on the water in

the creek and around the abutments of the dam. Plaintiff claimed that the higher water level raised the ice against the dam, thereby causing it to topple over. Defendant claimed plaintiff was negligent in not cutting a channel in the ice as had been done in previous years, and that plaintiff had been on notice of the impending water release. The Court of Appeals of New York ruled that plaintiff could not have known the release would happen so early in the year and that the need for the channel only arose when a thaw threatened to raise the water level. The judgment of the trial court for the plaintiff was reinstated. (Barker-Florida)
W70-08822

PEOPLE V MCDONNELL (PROTECTION OF PUBLIC RIGHTS IN CANAL).
262 Ill 114, 199 NE 93-96 (1935).

Descriptors: *Illinois, *Navigable waters, *Canals, *Public rights, Inland waterways, Ownership of beds, Navigation, Transportation, Real property, Land use, Jurisdiction, State governments, Federal government, Legislation, Water pollution, Waste disposal, Developed waters, Watercourses (Legal), Judicial decisions, Legal aspects.

Plaintiff citizens, through the state attorney general, sought to enjoin defendant's encroachment upon the bed of a canal and his disposal of garbage and other refuse into the canal. Defendant claimed title to a tract of land along the canal. Defendant also asserted that: (1) little water remained in the canal; (2) the canal was filled in, in many places; and (3) the state had abandoned the canal by not using it for 35 years. Plaintiffs contended that defendant's activities were a public nuisance and constituted an encroachment upon state property. The court, in holding for plaintiffs, found that the canal had been constructed by the state under the authority of the federal government and was a navigable body of water. Although the canal was an artificial waterway which was at present unnavigable, the state retained the power to preserve the canal for future transportation. No federal or state act had been passed expressly abandoning the canal. The canal could not lose its status as a navigable waterbody without an express act of Congress. The state, by statute, was empowered to protect public rights in the canal. (Hubener-Florida)
W70-08836

BOSTON AND A RR V COMMONWEALTH (CONTRACT FOR LAND TO CREATE A RESERVOIR).
6 NE2d 613-618 (Mass 1937).

Descriptors: *Massachusetts, *Administrative agencies, *Claims (Contracts), *Supervisory control (Power), Reservoirs, Contracts, Water supply, Reservoir storage, River basin development, Railroads, Water districts, Flooding, Submergence, Dam construction, Damstes, Municipal water, Land tenure, Land use, State governments, Administrative costs, Administrative decisions, Judicial decisions, Legislation, Legal aspects.

Plaintiff railroad brought action against the Commonwealth of Massachusetts to recover damages from an alleged breach of contract. Plaintiff contracted with the Metropolitan District Water Supply Commission, which purported to act for the Commonwealth, for the abandonment of plaintiff's railroad running through the Swift River Valley, wherein a storage reservoir was to be created. The property of the plaintiff railroad was included in the area to be flooded by the reservoir and upon which a dam was to be erected. Plaintiff removed all railroad appurtenances, did all things required of it under the contract, and delivered a deed conveying the land to the Commission. The Commonwealth, however, declined to remit the amount specified in the contract. It contended that the Commission was not authorized by statute to make any such binding contract without the approval of the Governor and Council, which approval was not obtained. The court, interpreting the applicable statutes, held that the Commission had sufficient authority to make contracts for the securing of additional water supply for the metropolitan water system and could bind the Commonwealth even without approval by the Governor and Council. (Dearing-Florida)
W70-08857

INSTITUTIONS FOR EFFECTIVE MANAGEMENT OF THE ENVIRONMENT.
National Academy of Sciences-National Academy of Engineering, Washington, D.C. Environmental Studies Board.

Washington, D.C., National Academy of Sciences - National Academy of Engineering, January 1970. 62 p.

Descriptors: *Environment, *Institutions, *Management, Environmental effects, Institutional constraints, Organizations, Administration, Planning.
Identifiers: *Environmental policy.

It is concluded that present institutional arrangements for effective environmental management are inadequate. A much greater emphasis on environmental monitoring is essential, as is the development of an Environmental Quality Index as a management tool, the establishment of a Board of Environmental Affairs within the Office of the President and a National Laboratory for Environmental Science. There is a need for continuing systematic analysis in support of efforts to deal with the environment and the national policies affecting the environment, and a new Institute for Environmental studies has been proposed to meet this need. (Davis-Chicago)
W70-08929

WATER QUALITY CONTROL IN CALIFORNIA,
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 05G.
W70-08943

RESPONSIBILITY IN WEATHER MODIFICATION OPERATION,
Fresno State Coll. Foundation, Calif. Atmospheric Water Resources Research; and South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
For primary bibliographic entry see Field 03B.
W70-08951

RECOVERY OF POLLUTED WATER,
Ontario Water Resources Commission, Toronto. Great Lakes Water Quality Surveys Program.
For primary bibliographic entry see Field 05G.
W70-08988

IS WATER DIFFERENT,
Department of Energy, Mines and Resources, Ottawa (Ontario). Policy and Planning Branch.
For primary bibliographic entry see Field 06C.
W70-08997

ONTARIO CONSERVATION AUTHORITIES--AN ADMINISTRATIVE APPROACH TO RESOURCES MANAGEMENT,
Metropolitan Toronto and Region Conservation Authority, Woodbridge (Ontario).
K. G. Higgs.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, 1969, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 261-265, 1969.

Descriptors: *Water law, *Water conservation, *Flood control, *Watershed management, Forest management, Water resources development, River basin development, Water management (Applied).
Identifiers: Ontario, Canada.

The Conservation Authorities Act of Ontario is so constituted that the watershed becomes the natural physiographic and hydrologic unit on which to base a rational program of flood control and water conservation. Provision is made in the Act for the management of all of the natural resources of the watershed and Authorities to carry out programs in forest management, fish and wildlife management and soil conservation. The Act also makes provision for Authorities to use and develop its lands acquired for conservation projects, for outdoor recreation and educational purposes. (See also W70-08597)
W70-08998

WATER SUPPLY AUGMENTATION BY REUSE
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05D.
W70-08999

6G. Ecologic Impact of Water Development

ENVIRONMENTAL IMPACT OF THE BIG CYPRESS SWAMP JETPORT.
Department of the Interior, Washington, D.C.
For primary bibliographic entry see Field 04C.
W70-08596

WASTE WATER DISPOSAL ENHANCES AN AREA ECOLOGY,
Campbell Soup Co., Napoleon, Ohio.
For primary bibliographic entry see Field 05D.
W70-08850

07. RESOURCES DATA

7A. Network Design

HYDROMETRIC SURVEYS,
Shawinigan Engineering Co. Ltd., Montreal (Quebec).
For primary bibliographic entry see Field 02E.
W70-08606

INSTRUMENTATION IN WATER QUALITY MONITORING AND SAMPLING,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05A.
W70-08616

HYDROMETEOROLOGICAL AUTOMATIC TELEMETERING STATIONS,
Meteorological Service of Canada, Toronto (Ontario).
For primary bibliographic entry see Field 02B.
W70-08618

7B. Data Acquisition

EMISSION BY UNDERWATER EXPLOSIONS,
French Inst. of Petroleum, Paris.
M. Lavergne.
Geophysics, Vol 35, No 3, p 419-435, June 1970. 17 p, 20 fig, 3 tab, 26 ref.

Descriptors: *Sounding, *Seismic studies, *Explosives, *Explosions, *Surveys, *Seismic properties, Bottom sediments, Sound waves, Instrumentation, Acoustics, Geophysics, Hydrography.
Identifiers: Underwater explosions, Seismic exploration.

Theoretical and experimental investigations of the seismic effects of underwater explosions of dynamite charges are described. Acoustic efficien

was determined in a broad frequency band. In e seismic frequency band, the partition of energy tween the shock wave and bubble pulses, the ismic effects of cavitation due to ghost reflection the air-water interface, and the damage caused marine life were determined. The seismic effi- ency of charges of the order of 100 gm can be nsiderably increased by dividing the charges and shooting at depth. Two or three properly spaced gm charges of dynamite, shot at a depth of about m, give the same result as a single charge of out 5 to 15 kg shot at a depth of 1 m. Marine sec- ons comparing caged charge shooting with con- ntional shooting in the same area are shown. (K- pp-USGS)
70-08585

EW TECHNIQUES IN THE SEARCH FOR ATER IN LIMESTONE,
uburn Univ., Alabama. Water Resources esearch Inst.; and Alabama State Geological Sur- y, University.
or primary bibliographic entry see Field 02F.
70-08609

ECODING AERIAL PHOTOGRAPHS OF GLA- IAL LANDSCAPES - INDICATORS OF ROUNDWATERS,
Ya. Meyer, and V. K. Markovskiy.
ransl for FSTC by Techtran Corp. Available from earinghouse as AD-696 181, $3.00 in paper opy, $0.65 in microfiche. Original source-Akad auk, SSSR, Laboratoria Aerometodov imenenie Aerometodov Dlia Izucheniia Grun- vykh VOD, p 69-79, 1962. US Army Foreign ience and Technology Center, Technical Trans- tion Report FSTC-HT-23-398-68, October 7, 969. 27 p, 8 fig, 10 ref. Project No 02RD500- 301.

escriptors: *Aerial photography, *Water sources development, *Glacial drift, *Terrain alysis, Geomorphology, Photogrammetry, Sur- eys, Mapping, Glaciation.
entifiers: Aerial photography interpretation.

haracteristics of landscape indicators of ground- aters are described for photointerpretation. Four acial types of landscape, including hilly-moraine, rumlin, morainic plain and terminal-moraine; ree water-glacial types of landscape, including ame (and os), lake-glacial plain and outwash ain; the karst erosion type of landscape; and eashores are described. Interpretation of water-re- ted features of these types of terrain on aerial notographs is discussed. (Knapp-USGS)
70-08610

NSTRUMENTATION AND OBSERVATION ECHNIQUES.

roceedings of Canadian Hydrology Symposium o 7, Victoria, British Columbia, scheduled for lay 14-15, 1969; held Oct 8-9, 1969, National esearch Council of Canada, Subcommittee on ydrology, 2 Vol, 1969. 343 p.

escriptors: *Conferences, *Instrumentation, Remote sensing, *Hydrologic data, Mapping, ata collections, Surveys, Water levels, Meteorolo- y, Water resources, Hydrogeology, Geophysics, elemetry, Data processing, Data transmission, ata storage and retrieval, Soil moisture, Ground- ater, Surface waters, Climatology.
dentifiers: Canada.

he primary purpose of the Seventh Canadian ydrology Symposium was to provide Canadian ydrologists with a reference work of not only raditional instruments and techniques but also a eference relative to those instruments and echniques now in the experimental and develop- ent stage. A second objective, as in previous sym- osia, was to stimulate an information exchange nd in this regard most of the program time was al- oted to discussion. The program included 15 original papers allocated to two sessions. The first session was devoted to instrumentation with emphasis on meteorological, soil moisture, ground- water, surface water, sedimentation and water quality instruments, and the second session con- centrated on new techniques. Included in this latter category was a paper on tracers and two panels with papers related to automatic stations and remote sensing techniques. (Knapp-USGS)
W70-08611

REVIEW HYDROMETEOROLOGICAL IN- STRUMENTATION,
Department of Transport, Toronto (Ontario). Meteorological Branch.
D. J. McKay.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 1-20, Vol 1, 1969. 20 p, 17 ref.

Descriptors: *Instrumentation, *Data collections, *Hydrologic data, Precipitation gages, Rain gages, Precipitation (Atmospheric), Telemetry, Snow sur- veys, Nuclear moisture meters, Air temperature, Winds, Solar radiation, Sampling, Humidity, Data processing.
Identifiers: Hydrometerological instrumentation, Canada.

Instrumentation designed to measure precipitation, temperature, and evaporation, are thoroughly reviewed and other meteorological instruments required in Canadian hydrological research and operations are discussed. Precipitation gages mea- sure rain or snow, or both liquid and solid precipitation. These instruments range from stan- dard basic equipment to sophisticated long-dura- tion recording devices with analog, digital, or telemetry output. Precipitation gages shields are described and the section on snow gages includes a discussion of snow samplers, snow pillows and radioactive measuring techniques. Evaporation in- strumentation includes pans, atmometers, and lysimeters. Measurements of meteorological parameters used in evaporation equations, such as air and water temperatures, wind, humidity and solar radiation are described. (Knapp-USGS)
W70-08612

SOIL MOISTURE,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
For primary bibliographic entry see Field 02G.
W70-08613

GROUNDWATER INSTRUMENTATION AND OBSERVATION TECHNIQUES,
Department of Energy, Mines and Resources, Ot- tawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02F.
W70-08614

SURFACE WATER,
Department of Energy, Mines and Resources, Ot- tawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02E.
W70-08615

AUTOMATIC CLIMATOLOGICAL RECORD- ING STATIONS IN REMOTE AREAS,
McGill Univ., Montreal (Quebec).
For primary bibliographic entry see Field 02B.
W70-08617

REMOTE SENSING GEOPHYSICAL APPLICA- TIONS TO HYDROLOGY,
Geological Survey of Canada, Electrical Methods Section.
For primary bibliographic entry see Field 02F.
W70-08619

AUTOMATIC HYDROLOGICAL DATA COL- LECTING STATIONS,
Department of Energy, Mines and Resources, Ot- tawa (Ontario). Marine Sciences Branch.
G. C. Dohler.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 219-235, Vol 1, 1969. 17 p, 4 fig, 3 ref.

Descriptors: *Telemetry, *Data collections, *Data transmission, *Hydrologic data, Tides, Water level fluctuations, Water levels, Navigation, Data processing, Data storage and retrieval, Logging (Recording).
Identifiers: Canada.

Several automatic tide and water level recording systems for observations over long periods, for telemetry using permanently rented telephone lines, for interrogation by a simple telephone call and by radio carrier technique, used for several years by the Tides and Water Levels Section of the Department of Energy, Mines and Resources, Canada, are described. In the Canadian Arctic, or in areas with long-sloping foreshores, or for water level measurements at the continental shelf, pres- sureoperated devices were developed, utilizing as much as possible, commercially available com- ponents. Automatic analogue recording devices were modified to make the data output compatible for computer usage. Digital recorders are being in- stalled on a trial basis at tide and water level sta- tions to improve the data gathering and processing procedures. (Knapp-USGS)
W70-08620

APPLICATIONS OF SATELLITE PHOTO- GRAPHS TO HYDROLOGY IN CANADA,
Department of Transport, Toronto (Ontario). Meteorological Branch.
For primary bibliographic entry see Field 02B.
W70-08622

REMOTE SENSING BY INFRA-RED TECHNIQUES,
Department of Transport, Toronto (Ontario). Meteorological Branch.
T. L. Richards.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 295-309, Vol 1, 1969. 15 p, 6 fig, 9 ref.

Descriptors: *Remote sensing, *Infrared radiation, *Radar, Temperature, Instrumentation, Water temperature, Spectroscopy, Mapping.
Identifiers: Microwave radiometry, Canada.

The Airborne Radiation Thermometer provides a fast, relatively accurate and operationally-proven technique for measuring surface water tempera- tures of large bodies of water. The basic theory of the infrared bolometer, some of the instrumenta- tion currently available, operational problems and their solutions and a method for correcting for the environmental error introduced by the atmosphere are discussed. A test and evaluation study of a rela- tively inexpensive analog system is reviewed and followed by a description of highly successful operational surveys which are still being con- ducted. A more sophisticated, and more expensive, infra-red scanner which provides detailed imagery of the surface water temperature patterns and newer microwave techniques are also reviewed and their relative merits discussed. (Knapp-USGS)
W70-08623

TRACER TECHNIQUES IN HYDROLOGY,
Guelph Univ. (Ontario). Dept. of Soil Science.
D. E. Elrick, and D. W. Lawson.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for

May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 155-187, Vol 1, 1969. 33 p, 1 fig, 2 tab, 119 ref.

Descriptors: *Tracers, *Tracking techniques, *Hydrogeology, Groundwater movement, Soil water movement, Sediments, Sediment transport, Precipitation (Atmospheric), Streamflow, Radioactivity techniques, Dye releases, Dispersion, Mixing, Diffusion, Porous media, Surface waters, Groundwater, Soil water, Instrumentation.
Identifiers: Canada.

Knowledge of water movement in many areas of the hydrological cycle can be aided by the use of tracer techniques. The present state of tracer technology, both radioactive and non-radioactive is reviewed and applications to the transport of water in the atmosphere throughout all areas of the hydrological cycle are discussed. The prerequisites of a good tracer in the atmosphere, soil, rivers, or groundwater are described and the performance of tracers such as tritium, colored dyes, and others is discussed with reference to particular applications. Measurement techniques are emphasized. (Knapp-USGS)
W70-08624

RADAR AS A REMOTE SENSOR FOR HYDROLOGY,
McGill Univ., Montreal (Quebec). Dept. of Physics.
For primary bibliographic entry see Field 02B.
W70-08625

INSTRUMENTATION AND TECHNIQUES IN SEDIMENT SURVEYING,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02J.
W70-08626

PROJECT CALORIC - AN INVESTIGATION OF HEAT RELEASE PATTERNS ASSOCIATED WITH PRESENT AND PLANNED ELECTRIC POWER PLANTS ON CAYUGA LAKE (Experimental Program),
Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
G. Neumaier, and D. Bock.
Cornell Aeronautical Laboratory, Inc., Final report, Nov., 1969. 61 p, 30 fig, 2 tab, 5 ref.

Descriptors: *Isotherms, *Thermocline, *Data collections, *On-site data collection, *Infrared radiation, *Remote sensing, Electric power plants, Nuclear power plants, Instrumentation, Bouyoucos blocks, Thermometer, Current meter, Digital computer, Telemetry, Computer program.

Experimental results are presented of the 12-month investigation of the heat release patterns associated with the present and planned electric power plants of Cayuga Lake. A detailed description is given of the measuring instrumentation and techniques that were used to obtain the data. The information is presented in two sections: The first, 'Aerial Infrared Measurements, describes the aerial measurement effort and presents the plots of isotherms in the lake. The second 'In-Lake Measurements,' describes the design and utilization of the in-lake instrumentation and presents typical examples of the lake data. (Osborne-Vanderbilt)
W70-08827

AUTOMATIC MASS SPECTROMETRIC ANALYSIS OF THE DEUTERIUM TO HYDROGEN RATIO IN NATURAL WATER,
Atomic Energy of Canada Ltd., Chalk River (Ontario). Chemistry and Materials Div.
W. M. Thurston.
The Review of Scientific Instruments, Vol 41, No 7, p 963-966, July 1970. 6 fig, 5 ref

Descriptors: *Deuterium, *Spectrometers, *Chemical analysis, *Automation, Instrumentation, Water analysis, Stable isotopes, Sampling, Analytical techniques.
Identifiers: *Automatic mass spectrometry, *Mass spectrometers.

A sampling concept to convert liquid water to vapor, without changes in the deuterium to hydrogen ratio, makes possible the construction of an automated mass spectrometer system for determining the deuterium to hydrogen ratio of water samples. The automatic cycle uses an increasing pressure approach to mass spectrometer dosing with excellent suppression of memory effects. Mass-2 ion abundance is used as the pressure sensor to actuate the single control valve in the automatic cycle, coupled with digital readout of the mass-3 ion abundance. A precision of 0.1 ppm at the natural concentration level is achieved with a cycle time of 2 min. The automatic cycle may be applied to on-stream gaseous hydrogen analysis with a precision of 0.1 ppm and a 50 sec cycle time. (Knapp-USGS)
W70-08937

A THREE COMPONENT DRAG PROBE FOR THE MEASUREMENT OF TURBULENT WATER VELOCITY FLUCTUATIONS,
Oregon State Univ., Corvallis. Dept. of Oceanography.
Marshall D. Earle, Jack H. Groelle, and George F. Beardsley, Jr.
The Review of Scientific Instruments, Vol 41, No 7, p 1021-1025, July 1970. 6 fig, 11 ref. Grant GA 998 (NSF).

Descriptors: *Turbulence, *Flowmeters, *Turbulent flow, Velocity, Current meters, Flow, Open channel flow, Instrumentation, Friction, Frequency, Fluid friction.
Identifiers: Turbulence meters, Drag probes.

Two spherical drag probes which use variable inductance devices as displacement transducers were built to measure turbulent water velocity fluctuations. The associated circuitry provides voltage outputs which are proportional to the three components of force acting on the spherical sensor of each probe. The probes respond to the fluid drag force and also to the fluid inertial force in an accelerating flow field. The frequency at which the response is 3dB down is 18 Hz for one probe and 41 Hz for the other. The instruments have been calibrated for oscillating flows with velocities from 10 to 150 cm/sec. (Knapp-USGS)
W70-08938

PRACTICAL METHODS FOR DETERMINING SEWAGE FLOW FOR ALL COMMUNITIES,
Metropolitan Corp. of Greater Winnipeg (Manitoba).
For primary bibliographic entry see Field 05D.
W70-08963

7C. Evaluation, Processing and Publication

AREAL EXTENSION OF STREAMFLOW INFORMATION BY MULTIPLE-REGRESSION TECHNIQUES,
Geological Survey, Washington, D.C. Surface Water Branch.
For primary bibliographic entry see Field 02E.
W70-08607

GLACIER DISCHARGE SIMULATION,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02C.
W70-08608

PHOTOGRAPHIC REMOTE SENSING FOR HYDROLOGY,
Guelph Univ. (Ontario).
Stanley H. Collins.
Proceedings of Canadian Hydrology Symposium No 7, Victoria, British Columbia, scheduled for May 14-15, 1969; held Oct 8-9, 1969, National Research Council of Canada, Subcommittee on Hydrology, p 283-294, Vol 1, 1969. 12 p, 1 fig, 1 ref.

Descriptors: *Aerial photography, *Remote sensing, *Hydrologic data, *Mapping, Data storage and retrieval, Photogrammetry, Water resources development, Rainfall-runoff relationships, Snow surveys, Infiltration, Water yield, Runoff, Streamflow, Flood damage, Evapotranspiration, Precipitation (Atmospheric).
Identifiers: Canada.

The uses of aerial photography in hydrology are reviewed briefly. Photography is discussed in its relationships with other remote sensing techniques and the reasons are given why the photographic techniques of recording, storage and mapping are valuable and why their uses are multiplying. An account is given of the development of new photographic mapping techniques, including a description of the production and properties of orthophotos. Brief mention is made of the new stereorthophotos and their advantages for resource development planning. (Knapp-USGS)
W70-08621

WATER INVENTORY STUDIES IN THE UNITED STATES AND THE I.H.D. PROGRAM,
National Committee for the International Hydrological Decade, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-09001

CANADIAN RESEARCH,
National Committee for the International Hydrological Decade, Ottawa (Ontario).
For primary bibliographic entry see Field 02E.
W70-09002

08. ENGINEERING WORKS

8A. Structures

GATES AND RELATED OPERATING EQUIPMENT,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
N. H. Latimer, and J. Pocher.
Engineering Journal-Canada, Vol 52, No 10, p 99-108, Oct 1969. 10 p, 10 fig, 4 ref.

Descriptors: *Hydraulic gates, Gate hoists, Intake gates, *Fixed wheel gates, Design, *Radial gates, Spillway gates, Corrosion, Paints, Foreign design practices, Corrosion control, Painting, Protective coatings, Gate seals, *Slide gates, *Handling equipment, Design criteria, Model tests, Hydraulic systems.
Identifiers: Peace River Proj (Canada), Canada, Portage Mountain Dam (Canada).

The design and operating characteristics of the gates and gate operating equipment used on the Portage Mountain Development in Canada are reviewed. The gates described include 13 ft-0 in. wide by 19 ft-6 in. high fixed-wheel intake gates designed for 265-ft head and operated by submerged linear hydraulic actuators, 15 ft-0 in. wide by 32 ft-10 in. high horizontally split draft tube gates, 50 ft-0 in. wide by 62 ft-0 in. high spillway radial gates, and 6 ft-0 in. wide by 8 ft-0 in. high free-discharge spillway slide gates. Material selection and design details of some important elements are outlined and operating experiences are reported on gates in service. Some conclusions are (1) protection against corrosion is important

gate design; (2) weight of paint should be taken nto account when determining hoisting effort, especially for large radial gates such as those used on the Portage Mountain Development where the weight of paint on each gate approached 10,000 lb; and (3) problems and innovations in gate construction should be reported in literature to aid designers. (USBR)
W70-08684

SEMI-CIRCULAR STOPLOGS,
International Power and Engineering Consultants Ltd, Vancouver (British Columbia).
J. J. Sled, and N. Purssell.
Engineering Journal - Canada, Vol 52, No 10, p. 17-124, Oct 1969. 8 p, 8 fig, 3 ref.

Descriptors: *Stop logs, Hydraulic gates, *Handling equipment, Cranes, Design, Construction, Diversion tunnels, Operation and maintenance, Cold weather construction, Model tests, Spillway gates, Installation, Foreign projects, Freezing, *Semicircular sections, River closures, Diversion.
Identifiers: *Closures, *Lifting devices, Peace River Proj, Can; Canada, Icing, Low temperature.

A description is given of the design, construction, and operation of 53-ft-dia semicircular stoplogs used for closing the 48-ft-dia diversion tunnels at the W A C Bennett Dam, Peace River Project, Canada. Handling equipmetnt consists of a specially designed lifting beam capable of automatically engaging and releasing the stoplogs, and a gantry crane for picking up stoplogs from a storage area and placing them in the entrance of any one of the 3 diversion tunnels. Handling equipment and stoplogs are designed for placing during low temperature conditions and at flows of 45,000 cfs through the tunnel that is being closed. The stoplogs are designed for a static head of 141 ft. Semicircular stoplogs were developed and have been used extensively in Sweden, but this use is believed to be the first on a major project in North America. Following completion of the final tunnel plug, the stoplogs and gantry crane were moved to the spillway area where the same system will provide upstream closure of the spillway channel and permit maintenance of the spillway radial control gates. (USBR)
W70-08686

HASKELL V STATE (LIABILITY FOR DAMAGES CAUSED BY INADEQUATE DAM DESIGN).
For primary bibliographic entry see Field 06E.
W70-08772

NORTHERN NEW YORK POWER CORP V STATE (CLAIMS ARISING FROM DAM CONSTRUCTION WHICH NECESSITATED REBUILDING OF A POWERPLANT).
For primary bibliographic entry see Field 06E.
W70-08777

BONDY V UTAH CONSTR CO (TUNNEL CONSTRUCTION INTERFERING WITH UNDERGROUND STREAMFLOW).
For primary bibliographic entry see Field 06E.
W70-08792

COOLING TOWERS GET BIGGER AND BETTER AS WATER DEMANDS GROW.
For primary bibliographic entry see Field 05D.
W70-08830

USES OF WASTE HEAT,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 05G.
W70-08832

8B. Hydraulics

BOUNDARY LAYER EFFECT ON THE COURSE OF THE SELF-PURIFICATION OF SMALL STREAMS,
Hydraulic Research Inst., Brno (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W70-08631

STILLING BASINS WITH WEDGE-SHAPED BAFFLE BLOCKS,
N. Narayana Pillai.
Water and Water Engineering, Vol 73, No 886, p 506-509, Dec 1969. 4 p, 7 fig, 5 ref.

Descriptors: *Stilling basins, Energy dissipation, *Baffles, Hydraulic models, Scour, Shape, Wedges, Hydraulics, Model studies, Hydraulic jump, Froude number, Cavitation, Foreign research.
Identifiers: *Chute blocks, *Baffle piers, Bureau of Reclamation, Bed profiles, India.

Hydraulic model studies were conducted in India to determine the suitability of wedge-shaped baffle blocks in stilling basins. Performance of the wedge-shaped baffle blocks was compared with that of rectangular baffle blocks used by the Bureau of Reclamation in the study of its Stilling Basin III model. The wedge-shaped baffle blocks can be placed farther up the jump than rectangular blocks, increasing the drag and energy dissipation considerably. Stilling basins using the wedge-shaped blocks can be developed to operate efficiently and are shorter in length. Because of the super-cavitating shape of the baffle blocks, susceptibility to cavitation is less. More detailed experiments are necessary to finalize the dimensions of the basins. (USBR)
W70-08676

LOW LEVEL OUTLETS,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
W. C. Goines, and E. A. Portfors.
Engineering Journal-Canada, Vol 52, No 10, p 71-75, Oct 1969. 5 p, 6 fig, 2 ref.

Descriptors: Outlets, *Outlet works, Valves, Foreign design practices, Foreign construction, *Energy dissipation, *High pressure valves, *Model tests, *High pressure gates, Hydraulic models, Model studies, Hydraulic design, Performance, Hydraulic gates and valves, Steel linings.
Identifiers: Outlet tunnels, *Hollow cone valves, Deflectors, Canada, Valve vibration, Energy dissipators, W A C Bennett Dam, Canada.

The design and operation of the low level outlets at W A C Bennett Dam in Canada are described. The outlets consist of twin 84-in.-dia hollow cone valves installed in the concrete plugs in 2 of the 3 diversion tunnels. Each hollow cone valve is backed up by two 84-in. ring follower gates designed to close under maximum head and full discharge. Hollow cone valves were selected for the outlets because of the design requirement for high energy dissipation within a relatively short portion of the tunnels for a wide range of flow conditions. The energy dissipation chambers immediately downstream from the concrete plugs consist of 43-ft-dia circular barrel sections incorporating deflector rings that project 4.5 ft inward from the barrel walls. The chambers are steel lined around the full circumference for a distance of 63 ft downstream from the plug and around the lower half for an additional 71 ft. Hydraulic model studies for determining the energy dissipation capability are described and results given. Hydroelastic model tests were run to ascertain response of the hollow cone valve components to flow-induced vibrations. (USBR)
W70-08677

SPILLWAY--PART I AND PART II,
Western Canada Hydraulic Labs. Ltd; and International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
J. W. Ball, P. E. Fawkes, and R. E. Johnson.
Engineering Journal-Canada, Vol 52, No 10, p 76-87, Oct 1969. 12 p, 15 fig, 3 ref, append.

Descriptors: Flood routing, *Spillways, Radial gates, Sluices, Foreign design practices, *Flip buckets, *Model tests, Model studies, *Hydraulic models, Chutes, Transitions (Structures), Hydraulic structures, Pressure distribution, Energy dissipation, Control structures, Groins, Tailwater, Scour, Surges.
Identifiers: *Ski-jump spillways, Spillway piers, Ogee crests, Canada, Chute spillways, Approach channels, W A C Bennett Dam, Canada.

The spillway at W A C Bennett Dam in Canada is one of the largest ski-jump-type spillways in the world. The spillway has a drop of 550 ft and is designed for a maximum discharge of 341,000 cfs. Main elements of the spillway are: an approach channel, three 50-ft-wide ogee sections containing 9 sluices and controlled by three 62-ft-high radial gates, a transition section, a discharge channel, and a steep chute that terminates in a flip bucket. Two papers describe tests of 2 hydraulic models. The inlet model was at a 1:84 scale and included a portion of the dam and reservoir, the approach channel, control structure, transition, and discharge channel. The outfall model was at a 1:96 scale and included the discharge channel, chute, flip bucket, and river tailrace area. Modifications to the approach channel, piers, and transition section resulting directly from the inlet model tests are described. Out-fall model tests resulted in a lower elevation, an increase in the lip angle, and an asymmetrical bowl-shape for the flip bucket. (USBR)
W70-08683

8C. Hydraulic Machinery

PEACE TRANSMISSION LINES, 500KV--DESIGN AND CONSTRUCTION,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
J. C. Stevens, and W. P. Johnson.
Engineering Journal-Canada, Vol 52, No 10, p 131-135, Oct 1969. 5 p, 2 fig, 2 tab, 2 ref.

Descriptors: *Transmission lines, *Extra high voltage, Dampers, *Extra long distance, Transmission towers, Guyed towers, Construction, Spacers, Electrical design, Electric insulation, Clearances, Construction costs, Helicopters, Bundled conductors, Electrical insulators, Foreign construction.
Identifiers: *Peace River Proj (Canada), Grille footings, Transmission line hardware, Electric conductors, Suspension insulators, Canada.

Design and construction features of the two 500-kv transmission lines from the Peace River Project in northeastern British Columbia are described. The 2 ehv lines will be capable of carrying the ultimate output of the Gordon M Shrum Generating Station to Southern Canadian power centers. The 576-mile line was energized at 500-kv during 1968. The 548-mile line was put into service as far as Kelly Lake Substation in 1969, with the remaining section under construction. Line parameters, tower and foundation design, conductor hardware, conductors, insulation and clearances, and construction are discussed. The use of guyed towers resulted in appreciable savings compared to all-rigid tower construction. Many miles of the line have been completed for 2 or 3 winters, and the service record is excellent. (USBR)
W70-08672

DC CIRCUITRY IN POWER SYSTEMS PROTECTION,
Northeast Utilities Service Co., Wethersfield, Conn.
T. U. Patel, and N. M. Reid.

Transmission and Distribution, Vol 22, No 4, p 60-63, Apr 1970. 4 p, 3 fig.

Descriptors: *Power system operations, *Reliability, Direct current, *Electric relays, *Faults (Electrical), Supervisory control (Power), Batteries, Fuses (Electrical), Power operation and maintenance, Electric wires, Electrolysis.
Identifiers: *Protection (Electrical), Electric conductors, Power system stability.

Power system protection requires reliability, high speed, stability, and sensitivity. To achieve this, equipment associated with protective schemes must function correctly. Direct-current circuitry performs a major function of the scheme, and care must be exercised in the design, selection, and maintenance of the protective equipment. The protective equipment may be used to isolate a fault only once, so there should be no risk of failure of the d-c circuitry. (USBR)
W70-08682

CONSTRUCTION PLANNING OF THE UNDERGROUND POWERPLANT,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 06B.
W70-08687

WORLD'S LARGEST HYPERBOLIC TOWER COOLS A POWER PLANT.
For primary bibliographic entry see Field 05D.
W70-08837

8D. Soil Mechanics

THE COLUMBIA RIVER DEVELOPMENT--A GEOTECHNICAL REVIEW,
British Columbia Hydro and Power Authority, Vancouver; and Thurber (R. C.) and Associates Ltd., Victoria (British Columbia).
R. C. McMordie, and G. C. Morgan.
Engineering Journal: Canada, Vol 53, No 2, p 9-17, 30, Feb 1970. 10 p, 11 fig, 1 tab, 8 ref, disc.

Descriptors: *Earth dams, *Dam design, *Dam construction, Differential settlement, Dam foundations, Dams, Foreign construction, Cracking, Zoned embankments, Foreign design practices, Dewatering, Cutoff trenches, Soil liquefaction, Underseepage, Underwater construction, Cutoff walls, Impervious blankets, Settlement (Structural), Flexible foundations.
Identifiers: *Columbia River Development, Canada, Dam stability, Canada, Seepage control, Slurry trenches, Embankment subsidence.

The current phase of the Columbia River Development in British Columbia consists of constructing 3 earthfill dams: Duncan, Hugh Keenleyside, and Mica. Some problems in design and construction of the dams and steps taken to cope with the problems are discussed. Problems at Duncan Dam were high foundation seepage and settlement and the possibility of foundation liquefaction. Hugh Keenleyside Dam has a deep, pervious foundation, and the site posed difficult dewatering problems. Problems at Mica Dam stemmed mainly from lack of precedent, particularly the behavior of earth and rockfill materials under high pressures. Control of embankment cracking was an important consideration for all 3 dams. Problems at Duncan were overcome by a reservoir blanket, a partial cut-off constructed by the slurry trench method, relief wells, flat embankment slopes, and control of the rate of embankment construction. At Hugh Keenleyside, a reservoir blanket was used to control seepage, and the need for dewatering was eliminated by constructing that portion of the dam below normal low water by controlled dumping of fill in the river. The approach used to overcome embankment cracking problems was to limit deformation of the fill as much as practicable and to provide in the design for development of cracks. (USBR)
W70-08670

LAND-SURFACE TILTING NEAR WHEELER RIDGE, SOUTHERN SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 08E.
W70-08953

8E. Rock Mechanics and Geology

YIELDABLE ROCK BOLTS FOR SHOCK LOADING AND GROUTED BOLTS FOR FASTER ROCK STABILIZATION,
East Rand Proprietary Mines Ltd., Boksburg (South Africa); and Colorado School of Mines, Golden.
W. D. Ortlepp, and John J. Reed.
Mines Magazine, Vol 60, No 3, p 12-17, Mar 1970. 5 p, 8 fig, 5 ref.

Descriptors: *Rock bolts, *Rock mechanics, *Rock excavation, Grouting, Tunnel design, Stabilization, Tunnels, Roof bolts, Tunneling, Foreign design practices, Underground structures.
Identifiers: *Rockbursts, Tunnel supports, Rock dilation, Underground openings, Yielding, South Africa, Rock pressures, Stress waves.

Yieldable rock bolts are effective in reinforcing underground openings against shock loading; fully grouted rock bolts have been very effective for reinforcement against static loading, especially when immediately installed and grouted. Analysis of support requirements shows that the inherent strength of a fractured rock wall tends to provide stability if the fractured rock is held in position and kept intact, even with relatively large displacements in the fractured shell. Design requirements for rock bolts are simple: the support must act quickly and maintain the restraining effect while yielding through appreciable displacements. Rock bolts are capable of supplying the early restraint, but have a limited yield capacity and may fail abruptly at high strain velocities. A yieldable rock bolt was developed and tested for resistance to blasting loads of the same order of magnitude experienced during rock bursts. Results indicate that a tunnel supported by yieldable rock bolts could survive all but the most violent rock bursts. An analysis comparing grouted with ungrouted rock bolts indicates a fully grouted rock bolt installed immediately after rock excavation, even though initially untensioned, should be several times more effective than a tensioned but ungrouted rock bolt. (USBR)
W70-08671

LAND-SURFACE TILTING NEAR WHEELER RIDGE, SOUTHERN SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Washington, D.C.
Francis S. Riley.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C, 20402 - Price $0.70. U S Geological Survey Professional Paper 497-G, P G1-G29, 1970. 29 p, 16 fig, 1 plate, 12 ref.

Descriptors: *Subsidence, *Withdrawal, *Aquifers, *California, Water levels, Compaction, Geology, Soil mechanics, Hydrograph analysis, Observation wells, Water utilization.
Identifiers: San Joaquin Valley (Calif), Tiltmeters.

Two continuous-recording liquid-level tiltmeters and three associated borehole extensometers recorded tilt at land surface and compaction in the upper 150 feet of alluvial-fan deposits at the site of the future Wheeler Ridge pumping plant of the California Aqueduct. The location, at the southern end of the San Joaquin Valley, borders on a large bowl of active land subsidence caused by compaction of the confined aquifer system under the stress of artesian-head decline. It is in an area subject also to subsidence due to near-surface hydrocompaction of moisture-deficient fan deposits. It is also an area of potential tectonic movement related to the historically active White Wolf fault. Significant susceptibility to hydrocompaction existed at depths greater than 150 feet. A special array of 24 bench marks installed within a radius of 2,400 feet from the pumping-plant site was leveled six times between August 1965 and September 1966. The areal pattern of tilting determined by the leveling agreed with the tiltmeter data in defining two principal periods of northward tilting per year; these periods coincided with the winter and summer irrigation seasons. In 1966 the total northward tilt was 42 microradians. (Knapp-USGS)
W70-08953

8G. Materials

USES OF METALS IN OFFSHORE STRUCTURES,
Texas A and M Univ., College Station.
L. Dale Webb.
Oceanology International, Vol 5, No 3, p 19-23, Mar 1970. 5 p, 2 fig, 3 tab.

Descriptors: *Metals, Metal coatings, *Corrosion, Fatigue (Mechanics), Chemical degradation, Corrosion control, Brittle failures, Structures, Aquatic environment, *Materials engineering, Structural design, Oceans, Materials stability, Cathodic protection, Pitting (Corrosion).
Identifiers: *Offshore structures, Electrochemical corrosion, Hydrogen embrittlement, Undersea aqueduct (Collective), Stress corrosion.

Materials for offshore structures must withstand design loads and survive the environment for necessary service life with minimal maintenance. Ordinary parameters of strength, density, cost, fabricability, and availability are necessary but not sufficient; environmental conditions must be faced. The offshore is chemical and mechanical. Marine fouling, chemical and electrochemical corrosion, fatigue fracture, hydrogen-embrittlement cracking, stress-corrosion cracking, and brittle fracture are discussed. Two tables compare the properties of metals for offshore structures. General rules for safe design of corrosion-prone structures are: (1) specify the more cathodic metals for critical structural components, (2) strive for a high ratio of anodic to cathodic metal, (3) coat cathodic members, and (4) do not coat anodic members. (USBR)
W70-08673

SPECIAL REPORT: FOUR PROCESSES BOLSTER FUSION WELDING,
Materials Engineering, Stamford, Conn.
John A. Vaccari.
Materials Engineering, Vol 71, No 4, p 40-46, Apr 1970. 7 p, 14 fig.

Descriptors: *Welded joints, Welders, *Welding, Electron beams, Laser, Metals, Metalwork, Metal pipes, Butt joints, Joints, Fabrication, Arc welding.
Identifiers: Welds, *Electron-beam welding, *Laser welding, Gas metal-arc welding, *TIG welding, Narrow gap welding, *Fusion welding.

Substantial progress has been made in recent years with 4 relatively new welding processes: electron beam, laser, hot wire TIG, and narrow gap welding. Advantages of electron beam welding stem from the ability to focus large concentrations of energy on a minute spot. Extremely narrow and deep welds can be made at a single pass and at much higher speeds than can be achieved by arc welding. Electron beam is suitable for welding almost any joint, most metals, a wide variety of dissimilar metals, and many nonmetallic materials. Laser welding is still a specialty process, but is being used in the electronics industry. Welds can be made in any atmosphere and through transparent materials such as inside vacuum tubes. Hot wire TIG welding has a deposition rate 3 to 5 times greater than conventional TIG welding, and is suitable for many steels and titanium and nickel alloys but is not recommended for aluminum and copper. A major commercial use is welding high-temperature, high

pressure pipe. Narrow gap welding is a gas-shielded, multipass, metal arc process designed for narrow welds in 4- to 8-in.-thick plates of ferrous and nonferrous metals. This process has advantages from reduction of the weld size, substantial savings in weld materials, fast welding speeds, and minimal residual stresses and heat-affected zones. (USBR)
W70-08675

GATES AND RELATED OPERATING EQUIPMENT,
International Power and Engineering Consultants Ltd., Vancouver (British Columbia).
For primary bibliographic entry see Field 08A.
W70-08684

8H. Rapid Excavation

EMISSION BY UNDERWATER EXPLOSIONS,
French Inst. of Petroleum, Paris.
For primary bibliographic entry see Field 07B.
W70-08585

RAPID-EXCAVATION CONCEPTS NOW IN FOCUS AS PARAMETERS AND DIMENSIONS EMERGE.

Engineering and Mining Journal, Vol 171, No 1, p 77-81, Jan 1970. 5 p, 3 fig.

Descriptors: *Tunneling, *Tunnel construction, Rock excavation, Costs, *Tunneling machines, Forecasting, Temperature, Automation, Research and development, Refrigeration, Gunite, *Boring machines, Tunnel pressures, Tunnel linings, Engineering geology.
Identifiers: *Rapid excavation, Tunnel supports, Raise boring, Rock pressures, Closed circuit television.

Faster tunneling at lower cost, in soft ground or hard rock, will be characteristic of mining and civil works in the next decade. Vast projects involving tunneling thousands of feet below the ground surface at phenomenal speeds will be possible. The present mode of stress relief and redistribution must be replaced by new methods. As tunneling speed is increased, tremendous increments of energy are expended in the tunnel, raising the temperature to dangerous levels. While refrigeration is the obvious answer, this may not be sufficient. Exhausting the hot air from the heading through an insulated pipe and conducting fresh refrigerated air in through another pipe may be necessary. Possibly, air will be taken into the heading in liquid form and evaporation will absorb the heat generated by the equipment. Another answer to some environmental problems is automation. The tunnel building process of the future could be almost completely automated and monitored by closed-circuit television. The labor force, other than the controllers, would be the troubleshooters and maintenance crews. Much research is in progress for developing techniques and machines for raise boring and tunneling. Some examples of these innovations are given. (USBR)
W70-08674

TUNNELING MACHINE S OF TODAY AND TOMORROW,
Jacobs Associates, San Francisco, Calif.
T. N. Williamson.
Report, National Academy of Sciences - Nat Research Council, Washington, D C, Jan 1970. 20 p, 5 fig, 10 ref.

Descriptors: *Tunneling, *Tunneling machines, Tunnel linings, Cutting, Tunnel construction, Forecasting, Underground structures, Reliability, Overbreak, Belt conveyors, Costs, Economics.
Identifiers: Tunnel supports, *Rapid excavation, Rock breakage, Cost savings, Cutters.
Much interest has been generated in tunnel boring by machine methods because of the increasing need for underground facilities. Developments in tunnel boring machine (TBM) are reviewed, beginning with the first uccessful operation in 1954 at Oahe Dam, S Dak, to the present time. More than half of the TBM applications have had at least a 40% time delay caused by inability to remove the excavated material as fast as it is produced; improvement in methods of concrete lining concurrently with boring is needed. Several advantages of tunnel boring machines are: (1) steel supports can be reduced to almost half, (2) concrete lining is reduced by 50% because of elimination of overbreak, and (3) lost time accidents are about 10% less than those on conventional tunnel jobs. Many developments are predicted for the TBM of the future. (USBR)
W70-08685

09. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

UNITED STATES WATER RESOURCES RESEARCH NEEDS,
Illinois Univ., Urbana. Coll. of Agriculture.
Roland R. Renne.
In: Proceedings of Symposium on Water Balance in North America, June 23-26, Banff, Alberta, Canada, American Water Resources Association, Urbana, Illinois, p 310-315, 1969.

Descriptors: *Water requirements, *United States, *Water resources development, *Research and development, Water balance, Water supply, Interbasin transfers, Planning, Research facilities.
Identifiers: *Water resources research.

U. S. overall water supply is considerably in excess of current use and projected demand in 1980 and 2000. Nevertheless, U.S. water problems are numerous, varied, and increasing. Approximately half of the nation will have very serious water problems in 1980 and acute problems in 2000 unless new approaches and significant adaptations of traditional ones are made. Only in the past five years has the U.S. embarked on a systematic, continuing, coordinated water resources research and planning program. Because of current budget and fiscal problems, available funds for needed research and planning are lagging behind recommended levels. Research objectives should be not only to improve methodology and criteria for more productive water resources planning and development but also to determine the kinds and precision of information needed and the analyses to evaluate alternatives. Several water research areas are described and related to current and prospective U.S. needs. (See also W70-08597)
W70-09003

9D. Grants, Contracts, and Research Act Allotments

FEDERAL GRANTS AVAILABLE FOR INDUSTRIAL POLLUTION CONTROL,
Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05D.
W70-08969

10. SCIENTIFIC AND TECHNICAL INFORMATION

THE EFFECTS OF ELEVATED TEMPERATURE UPON AQUATIC INVERTEBRATES-A REVIEW OF LITERATURE RELATING TO FRESH WATER AND MARINE INVERTEBRATES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography; and John Hopkins Univ., Baltimore, Md. Dept. of Environmental Engineering Science.
For primary bibliographic entry see Field 05C.
W70-08835

MICROFICHE VIEWING EQUIPMENT,
Defense Documentation Center, Alexandria, Va.
Ronald F. Gordon.
Available from the Clearinghouse as AD-701 600, $3.00 in paper copy, $0.65 in microfiche. Rept. No. DDC-TR-70-1, March, 1970, 55 p.

Descriptors: *Equipment.
Identifiers: *Microfiche, *Microforms, *Microfilm, Film viewers, Reader-printers, Reprography, Viewing equipment.

A descriptive directory is provided of microfiche readers and reader/printers manufactured in the features and specifications are provided for each of the 47 models surveyed. Viewer information is uniformly listed throughout the publication to aid comparison.
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3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 22
NOVEMBER 15, 1970

W70-09011 -- W70-09510

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
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UIVALENCE OF ANOMALOUS WATER D SILICIC ACID SOLUTIONS,
stralian National Univ., Canberra. Research ool of Physical Sciences.
V. Morariu, R. Mills, and L. A. Woolf.
ure, Vol 227, No 5256, p 373-374, July 25, 0. 2 p, 1 fig, 10 ref.

criptors: *Water structure, *Silica, *Gels, ter properties, Water chemistry, Molecular cture.
ntifiers: Polywater, Anomalous water.

possible to prepare, without the intermediary inely drawn capillaries, a silica solution which sesses most of the features commonly as- iated with anomalous water. All the features of malous water can be exactly reproduced by in- ducing a solution of silicic acid into the capilla- . Anomalous water and silicic acid solutions e many features in common. There is now a wing body of results which show that the ex- nce of a true polymeric form of water is doubt- (Knapp-USGS)
0-09125

BONDING MODEL FOR ANOMALOUS TER,
nceton Univ., N.J. Dept. of Chemistry.
and C. Allen.
ure, Vol 227, No 5256, p 372-373, July 25, 0. 2 p, 1 fig, 8 ref.

scriptors: *Water structure, *Hydrogen bond- , Water properties, Water chemistry, Molecular cture.
ntifiers: Anomalous water, Polywater.

nomalous water structure rings in three dimen- ns are proposed because they lower the energy the relatively small, delocalized, covalent-like nding and especially because of the large delung (ionic) energy which arises from the ge oxygen-hydrogen charge separation. Four n-up electrons at the corners of a tetrahedron l four spin-down electrons at the corners of an erpenetrating tetrahedron pointing the opposite y are arranged around each oxygen center. nes of hexagons stack in the graphite-like pat- n. The type of symmetric divalent hydrogen nding under consideration here differs from the lrogen bridges found in boron hydrides in that end atoms are electron rich rather than elec- n deficient, and in this circumstance the bonding st compete with the well established conven- nal, asymmetric hydrogen bonding widely found the electron rich, electro-negative atoms N, O l F. (Knapp-USGS)
0-09126

3. Aqueous Solutions and Suspensions

UIVALENCE OF ANOMALOUS WATER D SILICIC ACID SOLUTIONS,
stralian National Univ., Canberra. Research nool of Physical Sciences.
r primary bibliographic entry see Field 01A.
0-09125

BONDING MODEL FOR ANOMALOUS ATER,
nceton Univ., N.J. Dept. of Chemistry.
r primary bibliographic entry see Field 01A.
0-09126

02. WATER CYCLE

2A. General

EFFECTS OF FOREST CLEAR-FELLING ON THE STORM HYDROGRAPH,
Georgia Univ., Athens.
For primary bibliographic entry see Field 03B.
W70-09117

PLANT COVER, RUNOFF, AND SEDIMENT YIELD RELATIONSHIPS ON MANCOS SHALE IN WESTERN COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02J.
W70-09118

ACOUSTIC SUBBOTTOM PROFILING SYSTEMS, A STATE-OF-THE-ART SURVEY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
R. T. Saucier.
Sponsored by U.S. Army Engineer Division, Lower Mississippi Valley. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report S-70-1, April 1970. 44 p, 1 tab, 13 pl, 38 ref.

Descriptors: *Seismic studies, Geophysics, Channel morphology, *Streambeds.
Identifiers: *Acoustic profiling systems.

A literature survey, data sheets, discussions with manufacturers and users, and field tests were used to assess the current status of acoustic subbottom profiling systems. Emphasis was on establishing operating principles, methods of survey operation, inherent capabilities and limitations, environmental restrictions, and availability, particularly from the standpoint of conditions and problems in the Lower Mississippi Valley area in shallow, fresh to brackish water bodies. Acoustic profiling systems are classified according to the method by which the sound energy is produced; i.e., piezoelectric and magnetostrictive transducer pingers, electromechanical-type transducers or boomers, sparkers and arcers, gas guns, air guns, and others. Either transducers or hydrophones are used to detect the reflecting acoustic signals. Operational considerations such as size and weight of equipment, and environmental considerations such as water depth were also taken into account. (Spivey-Waterways Experiment Station)
W70-09176

DIGITAL ANALYSIS OF AREAL FLOW IN MULTIAQUIFER GROUNDWATER SYSTEMS: A QUASI THREE-DIMENSIONAL MODEL,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W70-09197

ELEMENTS OF THE WATER BALANCE OF SMALL RESERVOIRS OF THE CENTRAL CHERNOZEM PROVINCES,
For primary bibliographic entry see Field 02H.
W70-09314

ON THE SOLUTION OF INVERSE PROBLEMS IN HYDROGEOLOGY (FRENCH),
SCET/Cooperation--BCA, Puteaux (France).
For primary bibliographic entry see Field 02F.
W70-09371

ON THE SYSTEMS APPROACH IN HYDROLOGY,
Purdue Univ., Lafayette, Ind. Dept. of Aeronautics, Astronautics, and Engineering Sciences.
Venkateswararao Vemuri, and Narasimhamurty Vemuri.
Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 17-38, June 1970. 22 p, 3 fig, 35 ref.

Descriptors: *Systems analysis, *Mathematical models, Hydrology, Operations research, Input-output analysis, Model studies, Data storage and retrieval, Simulation analysis, Digital computers, Linear programming, Dynamic programming, Computer programs.
Identifiers: Hydrologic systems.

A general theoretic framework for hydrologic systems research includes dynamical, structural, spatial and behavioral aspects of modeling with predictive powers. Many hydrologic problems can be effectively studied by systems analysis. The process of system modeling for large-scale, non-linear, time-lag systems can be rationalized by suitably identifying and modeling subsystems. When computers are used as modeling tools methods of formulating the problem, choice of the computer used, and choice of performance criteria greatly influence the results. This in turn imposes certain limits on the validity of computer simulated models. These aspects are discussed by studying the nature of hydrologic systems and the nature of the associated inverse problems and requirements for validating the models. (Knapp-USGS)
W70-09385

APPLICATION OF REGRESSION ANALYSIS IN HYDROLOGY,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 07C.
W70-09391

2B. Precipitation

INFLUENCE OF EVAPORATION FROM LAKE BAIKAL ON PRECIPITATION IN THE SURROUNDING REGIONS,
For primary bibliographic entry see Field 02D.
W70-09096

MICROELEMENTS IN ATMOSPHERIC PRECIPITATION IN THE OTKAZNENSKIY RESERVOIR AREA,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
G. S. Konovalov, and T. Kh. Kolesnikova.
Translated from Hydrochemical Materials (Gidrokhimicheskiye Materialy), Vol 49, p 74-80, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 166-170, 1969. 5 p, 1 tab, 15 ref.

Descriptors: *Trace elements, *Precipitation (Atmospheric), Chemistry of precipitation, Rainfall, Water chemistry, Water quality, Reservoirs.
Identifiers: USSR, Otkaznenskiy Reservoir.

To determine the trace elements received by Otkaznenskiy Reservoir from precipitation, samples were collected and analyzed. The precipitation collector is installed 2 m above the reservoir dam. The lid of the collector is removed only during precipitation; thus the device collects mainly liquid precipitation. The solid particles that entered the sample were atmospheric dust falling during precipitation. Boron, fluorine, bromine and iodine were determined chemically in the precipitation samples. Vanadium, manganese, cobalt, nickel, copper, molybdenum, silver, tin, lead, iron, aluminum, titanium, and bismuth were determined by the chemical-spectral method. Some of the 17 elements studied were not found in the precipitation of the Otkaznenskiy Reservoir area (cobalt, molybdenum, silver, tin, lead, and bismuth). The content of the other elements is high. This is associated with local conditions and attributable to the dry climate, scant vegetation, and wind action, which is responsible for the high dustiness of the atmosphere. (Knapp-USGS)
W70-09099

REASONS FOR CLIMATIC CHANGES IN THE GEOLOGICAL PAST,
Main Geophysical Observatory, Leningrad (USSR).
M. I. Budyko.
Translated from Bulletin of the USSR Academy of Sciences, Geographic Series (Izvestiya Akad. nauk SSSR, Ser. geograf.), No 1, p 5-16, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 183-192, 1969. 10 p, 6 fig, 24 ref.

Descriptors: *Pleistocene epoch, *Paleoclimatology, Climatology, Climates, Glaciers, Solar radiation, Dusts, Volcanoes, Humidity, Precipitation (Atmospheric), Synoptic analysis.
Identifiers: USSR, Climatic change.

The main climatic characteristics of various geological epochs are determined quantitatively on the basis of a numerical model of the climatic regime as a function of external factors affecting the climate. It is found that the leading causes of the development of Quaternary ice ages were changes in the transparency of the earth's atmosphere produced by volcanic activity, the uplifting of continents, and the narrowing of straits connecting the Arctic Ocean with oceans at low latitudes. (Knapp-USGS)
W70-09102

INDIRECT METHOD FOR COMPUTING THE DURATION OF PRECIPITATION,
I. A. Aframeyeva.
Translated from Voyeykov Main Geophysical Observatory (Trudy GGO), No 247, p 76-81, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 139-143, 1969. 5 p, 1 fig, 5 tab, 5 ref.

Descriptors: *Precipitation (Atmospheric), *Duration curves, *Time, Depth-area-duration analysis, Frequency, Statistics, Statistical methods, Timing, Rainfall, Streamflow forecasting, Data collections.
Identifiers: Europe, USSR, Precipitation duration.

A study was made of the duration of precipitation in Western Europe. Conversion factors make it possible to calculate the duration of precipitation by using the relationship between the number of days with and the actual duration of precipitation at any station in this region. The duration of precipitation depends not only on the time of the year, but also on the physiographic conditions of a given region. Four regions are considered: (1) central part of Western Europe; (2) Scandinavia; (3) southeastern part of Western Europe; and (4) England and Ireland. Average conversion factors were computed for each of these regions and from them the average monthly total duration of precipitation was tabulated for the characteristic months of each season. (Knapp-USGS)
W70-09106

CHEMICAL COMPOSITION OF PRECIPITATION IN REGIONS OF THE SOVIET UNION,
Main Geophysical Observatory, Leningrad (USSR).
O. P. Petrenchuk, and E. S. Selezneva.
Journal of Geophysical Research, Vol 75, No 18, p 3629-3634, June 20, 1970. 6 p, 1 fig, 7 tab, 17 ref.

Descriptors: *Air pollution, *Fallout, *Chemistry of precipitation, *Water chemistry, Nucleation, Precipitation (Atmospheric), Mineralogy, Solutes, Dusts, Sampling, Data collections, Path of pollutants.
Identifiers: *USSR.

The relative importance of the formation of droplets on condensation nuclei and the capture of contaminants by cloud and precipitation elements in various atmospheric layers, is evaluated. In the clean northern regions of the USSR the cloud contribution constitutes 55% of the total precipitation mineralization. In the southern regions, with heavy pollution of the atmospheric boundary layer, washout of pollutants in the subcloud layer is the predominant process. Here the cloud contribution constitutes only 20-25%. Therefore, precipitation plays a significant role in the self-cleaning of the atmosphere from admixtures of natural and artificial origin. (Knapp-USGS)
W70-09133

CHEMICAL HYDROLOGY OF REGIONS OF EAST ANTARCTICA,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-09134

A STUDY OF HEAT TRANSFER COEFFICIENTS IN THE LOWEST 400 METERS OF THE ATMOSPHERE,
New York Univ., Bronx. Dept. of Meteorology and Oceanography.
Sharon S. Wu.
Journal of Geophysical Research, Vol. 70, No. 8, p 1801-1807, April 1965, 6 fig, 10 ref.

Descriptors: *Heat transfer, *Air temperature, *Heat flow, Turbulence, Advection, Winds, Boundary processes, Meteorological data, Anemometers, Density.
Identifiers: *Heat exchange coefficient, Steady state, Diffusion coefficient.

The primary purpose of this study is to determine an appropriate formula for the turbulent heat exchange coefficient in the atmosphere. The heat-transfer equation for the atmosphere is integrated numerically for a 24-hour period; various forms are assumed for the heat exchange coefficient KH, which does not explicitly include effects of windshear. The excess of energy in the lower layers in the experiments might be due to the exact form of KH used. Yet, the results are in reasonably good agreement with observation. The maximum error is about 1.5 deg K when the ratio KH/Km = r is 1 and a scaling height is made a function of the local potential temperature gradient where Km is the heat exchange coefficient taking into account the wind shear. However, since the temperature at 2400 minus the temperature at 0000 is not the same at all heights, there is perhaps significant advection or a significant height gradient of advection present. This involves a process occurring in nature which is not described by the equation employed. (Osborne-Vanderbilt)
W70-09156

TURBULENT DIFFUSION IN A STABLY STRATIFIED SHEAR LAYER,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 08B.
W70-09173

CLIMATIC OSCILLATIONS 1200-2000 A D,
Copenhagen Univ. (Denmark). H. C. Orsted Inst.; and Army Terrestrial Sciences Center, Hanover, N.H.
S. J. Johnsen, W. Dansgaard, H. B. Clausen, and C. C. Langway.
Nature, Vol 227, No 5257, p 482-483, August 1, 1970. 2 p, 2 fig, 14 ref.

Descriptors: *Paleoclimatology, *Arctic, Glaciers, Ice, Sampling, Stable isotopes.
Identifiers: Greenland.

Using the isotopic composition of glacier ice as a climatic indicator is based on the fact that the concentration of heavy stable isotopes (deuterium and oxygen-18) in high polar snow increases with the temperature of formation of the snow. A unique possibility for studying palaeoclimates was offered when the US Army Cold Region Research and Engineering Laboratory succeeded in recovering a 1,400 meter long surface-to-bottom ice core from Camp Century on the North Greenland ice sheet. The stable isotope technique applied on the deep ice core gave an unbroken and detailed climatic record spanning probably 100,000 years. This paper presents the results of a detailed study of the ice which accumulated during the last 800 years. (Knapp-USGS)
W70-09224

STRONTIUM 90 CONCENTRATIONS IN SURFACE AIR: NORTH AMERICA VERSUS ATLANTIC OCEAN FROM 1966 TO 1969,
New York Operations Office (AEC), N.Y. Health and Safety Lab.
Peter C. Freudenthal.
Journal of Geophysical Research, Vol 75, No 21, p 4089-4096, July 20, 1970. 8 p, 5 fig, 2 tab, 14 ref.

Descriptors: *Fallout, *Strontium radioisotopes, Aerosols, Atmosphere, Pollutants, Precipitation (Atmospheric), Atmospheric physics, Meteorology, Atlantic Ocean.
Identifiers: North America.

Strontium 90 in surface air has been measured continually for three years, February 1966 to January 1969, at four North Atlantic Ocean weather stations to compare fallout processes over the ocean with those over land. Between 35 deg N and 55 deg N, concentrations over land were an average 1.1 times greater than those over the ocean. The relative concentration varied with both season and latitude, being greater in the north and during the summer. This variation seems to correlate better with monsoonal meteorological processes than with the suggested process of aerosol scavenging by ocean spray. (Knapp-USGS)
W70-09229

WATER VAPOR BALANCE OF THE ATMOSPHERE FROM FIVE YEARS OF HEMISPHERIC DATA,
Massachusetts Inst. of Tech., Cambridge. Dept. of Technology.
Jose P. Peixoto.
Nordic Hydrology, Vol 1, No 2, p 120-138, 1970. 19 p, 6 fig, 25 ref. NSF Grant No GA-1310X.

Descriptors: *Water balance, *Climatology, *Synoptic analysis, *Climatic data, Hydrologic cycle, Data processing, Mapping, Topography, Weather data, Automation, Charts, Data collections, Maps, Networks, Surveys, Synthesis, Weather forecasting.
Identifiers: Atmospheric water vapor balance.

The atmospheric balance of water vapor for the northern hemisphere was investigated through entirely automatic data processing and objective analysis procedures, to assess the potentialities of these methods by examining a large sample of results. The study was based on five years of daily observations taken at about 800 meteorological stations. The final maps of the distribution fields of mean precipitable water content and of zonal and meridional transports of water vapor in the atmosphere are presented and discussed. The structure and the implications of the water vapor divergence map for hydrology are treated. Finally the water vapor balance on a planetary scale is discussed and the results are compared with evidence obtained from climatological and hydrological sources. The five-year averages of the various fields appear to give consistent results and mainly agree with previous findings. The areas of highest water vapor content are shown over the equatorial regions of South America, eastern and western Pacific, the Indian Ocean, and equatorial West Africa. The region of lowest precipitable water is found over the Arctic. (Knapp-USGS)
W70-09238

SOIL MOISTURE PRESSURE IN SOME CLIMATIC ZONES,
Institut Prikladnoi Geofiziki, Leningrad (USSR).
For primary bibliographic entry see Field 02G.
W70-09291

NFILTRATION IN TERMS OF SOIL IOISTURE, RAIN INTENSITY AND DEPTH OF AINFALL,
Hungarian Univ. of Agricultural Sciences, Godollo (Hungary).
or primary bibliographic entry see Field 02G.
/70-09301

SELECTED ANNOTATED BIBLIOGRAPHY F ENVIRONMENTAL STUDIES OF POLAND,
ir Force Environmental Technical Applications enter.
lvin L. Smith, Jr.
TAC Technical Note 70-6, June, 1970. 53 p, 153 f.

escriptors: *Climatology, *Environmental ef-cts, Meteorology, *Precipitation (Atmospheric), ydrology, *Air temperature, Temperature, En-ronment.
lentifiers: Mesoclimatology, Poland.

his bibliography contains 153 references to en-ronmental studies (1960-1969) concerning the olish Peoples Republic (POLAND). Forty-three f the items referenced translations of Polish arti-es and are placed separately in the text. Five reviously published bibliographies on the same rea are also referenced. Entries are entered phabetically by author and a Subject Index is in-uded.
/70-09456

C. Snow, Ice, and Frost

IETHODS OF COMPUTING MAXIMUM SOIL REEZING DEPTH,
I. V. Zavarina.
ranslated from Voyeykov Main Geophysical Ob-ervatory (Trudy GGO), No 246, p 73-82, 1969. oviet Hydrology: Selected Papers, Issue No 2, p 31-139, 1969. 9 p, 3 fig, 1 tab, 11 ref.

)escriptors: *Frost, *Frozen soils, *Forecasting, lanning, Construction, Freezing, Melting, Synop-c analysis, Surveys, Frequency analysis, Probabili-y, Climatology, Mapping, Data collections, Cli-natic data.
lentifiers: Frost forecasting, USSR.

The Hydrometeorological Service of the USSR has ollected extensive observational data on soil tem-erature at various depths. From the long-period ecords it is now possible to construct curves of the ntegral frequency of various air temperatures or oil freezing depths and to determine values of iven integral probability. Nomograms are given or computing freezing depths and probabilities nder natural cover. Depth of freezing under bare oil was determined at only a few stations; there-ore, there is more uncertainty in frost forecasting n urban areas than in the vegetated areas. (Knapp-JSGS)
W70-09104

AN ANALYSIS OF ICE LENS FORMATION,
Army Terrestrial Sciences Center, Hanover, N.H.
Shunsuke Takagi.
Water Resources Research, Vol 6, No 3, p 736-749, June 1970. 14 p, 3 fig, 1 tab, 39 ref.

Descriptors: *Frost, *Freezing, *Frost heaving, Frost action, Frozen ground, Ice, Soil water move-ment, Heat transfer, Mass transfer, Mathematical models, Mathematical studies, Adsorption.
Identifiers: Ice lenses (Frost).

A mechanism of ice lens formation is based on the assumption that its main cause is the simulataneous flow of heat and water. The differential equations thus formulated are solved approximately by the use of a generalization of Goodman's integral method. The result is not completely satisfactory when compared with an experiment. The existence of a solution to the differential equations of ice lens formation is demonstrated. The solution exists for a very narrow range of initial water content deter-mined by the amount of surcharge on the ice lens. The narrowness of the range probably accounts for the observed intermittence of lenses. The Good-man technique or any generalization of it cannot yield a satisfactory solution of the problem. A sim-plification of Portnov's method has been found. With development of the mathematical method, improvements in the assumed mechanism, and refinements in the measurements of soil properties, we may be able to completely formulate frost heav-ing and thereby solve a long-standing problem. (K-napp-USGS)
W70-09114

CHEMICAL HYDROLOGY OF REGIONS OF EAST ANTARCTICA,
Nauchno Issledovatelskii Gidrokhimicheskii In-stitut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-09134

CLIMATIC OSCILLATIONS 1200-2000 A D,
Copenhagen Univ. (Denmark). H. C. Orsted Inst.; and Army Terrestrial Sciences Center, Hanover, N.H.
For primary bibliographic entry see Field 02B.
W70-09224

MEASUREMENT OF THE THERMAL CON-DUCTIVITY OF FROST BY A TRANSIENT HOT-WIRE TECHNIQUE,
North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
J. C. Mulligan.
Journal of Geophysical Research, Vol 75, No 21, p 4180-4183, July 20, 1970. 4 p, 3 fig, 8 ref.

Descriptors: *Frost, *Frozen ground, *Instrumen-tation, *Thermal conductivity, Thermometers, Soil physical properties, Geothermal studies, Heat flow.
Identifiers: Hot-wire thermometers.

A transient method of measuring thermal conduc-tivity is described, along with the results of some experiments with frost. The method utilized a fine wire thermojunction, which is imbedded in the frost and heated at a constant rate with a radio frequency current. The transient temperature response of the wire is then obtained by electronic filtering and is related to the thermal properties of the frost by the theory of heat conduction from a line heat source in an infinite medium. The technique was found to work well with frost and is believed to provide a means of making the rapid and local measurements that are necessary for non-homogeneous and transient media. (Knapp-USGS)
W70-09233

PUMPING TESTS AND HYDROGEOLOGICAL INVESTIGATIONS OF AN ARTESIAN AQUIFER NEAR HORSENS, DENMARK,
Geological Survey of Denmark, Copenhagen.
For primary bibliographic entry see Field 02F.
W70-09237

CHARACTERISTICS OF PERMAFROST AND OF THE ACTIVE LAYER IN WEST SIBERIA,
N. A. Shpolyanskaya.
Translated from Herald of Moscow State Universi-ty, Geographic Series (Vestnik MGU, ser. geogr.), No 3, p 88-94, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 195-200, 1969. 6 p, 2 fig, 2 tab, 8 ref.

Descriptors: *Permafrost, *Arctic, *Tundra, Frozen soils, Frozen ground, Mapping, Surveys, Soil types, Cold regions, Ice, Soil properties, Cli-matology, Paleoclimatology, Pleistocene epoch.
Identifiers: *USSR, *West Siberia.

The distribution and temperature of present-day permafrost in West Siberia are determined by two major factors: first, the present climate and heat exchange between the soil surface and the at-mosphere, and, second, the evolution of permafrost in the Quaternary. The history of permafrost in West Siberia is peculiar in that the permafrost partly thawed from the surface during the Holocene, stopped thawing, and then the rocks froze again. Three large regions formed as a result of this freezing that differ in the ratio of layers of recent and old permafrost. These are the region of continuous recent and old (relict)permafrost, the region of scattered permafrost, and the region of old, deep-seated permafrost. Each of these regions is subdivided into geothermal zones that differ in the temperature, thickness, and spatial ratio of thawed and frozen rocks. They show distinct zonality, determined by the corresponding distribu-tion of present physiographic conditions in West Siberia. (Knapp-USGS)
W70-09257

PREPARATORY REPORT OF THE TECHNI-CAL SUBCOMMITTEE ON SNOW.
Ministry of Works, Wellington (New Zealand). Water and Soil Div.

New Zealand National Committee for the Interna-tional Hydrological Decade, Ministry of Works, Wellington, 1969. 19 p, 1 fig, 1 tab.

Descriptors: *Snow surveys, *Runoff forecasting, Foreign research, Snowpacks, Snow management, International Hydrological decade, Planning, Water resources development.
Identifiers: *New Zealand.

The New Zealand Electricity Department was par-ticularly interested in the quantity of water stored as annual snow and released during spring and summer. If forecasts could be made, considerable economies would be possible in the storage pro-vided in reservoirs. Forecasts would also be of value for irrigation and for flood mitigation. (K-napp-USGS)
W70-09351

EXPERIENCES WITH SNOW PILLOWS IN NORWAY,
Norwegian Water Resources and Electricity Board, Oslo.
Arne Tollan.
Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 113-120, June 1970. 8 p, 6 fig, 6 ref.

Descriptors: *Snow surveys, *Precipitation gages, *International Hydrological Decade, Snowmelt, Snowpacks, Streamflow forecasting, Snow manage-ment, Water yield, Gaging stations, Data collec-tions.
Identifiers: Snow pillows, Norway.

Snow pillows have been in use since 1961-62 in the USA and a great number of snow pillows are now in operation in USA and Canada. From the winter 1967-68 a snow pillow has been in operation in the representative basin Filefjell in Norway. Two addi-tional pillows were installed during the winter 1968-69 in the representative basins Romerike and Sagelva. This report summarizes experience with snow pillows in Filefjell and Romerike as a part of the program conducted by the Norwegian national committee for the IHD. Snow pillows have proved to be a powerful tool in the study of reliability of conventional precipitation measurements, particu-larly in mountain areas. Combined with measure-ments of snowmelt run-off, pillow records may also throw light on the question of evaporation from snow cover. Pillow sites should be selected near ex-isting meteorological stations, or be equipped with a certain minimum of meteorological instruments like precipitation gage, thermograph and anemometer. When reliable and sufficient observa-tions are available, pillow records can be used to study melt water formation as a function of climatic parameters. If the purpose of the pillow is flood forecasting or prognosis of inflow to reservoirs, it is

of utmost importance to choose representative sites, based on extensive field surveying. (Knapp-USGS)
W70-09375

FREEZING AND THAWING EFFECTS ON DRAINAGE,
Agricultural Research Service, Burlington, Vt. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
W70-09380

GEOPHYSICAL STUDIES IN PERMAFROST REGIONS IN THE U.S.S.R.,
Moscow State Univ. (USSR). Dept. of Geophysics.
For primary bibliographic entry see Field 07B.
W70-09396

THE PHYSICS OF GLACIERS,
Commonwealth and International Library of Science Technology, Engineering and Liberal Studies, Ottawa (Ontario).
W. S. B. Paterson.
London, Pergamon Press, Ltd, 1969, 250 p.

Descriptors: *Glaciers, *Flow, *Ice, *Rheology, Freezing, Melting, Snow, Mechanical properties, Plasticity, Viscosity, Physical properties, Mathematical studies.
Identifiers: Glacier physics.

The physical principles underlying the behaviour of glaciers and ice sheets are explained, as far as they are understood at the present time. While the book is intended primarily for those starting research in the subject, established workers in glacier studies and in related fields should find it useful. The treatment is at about the graduate student level. The approach of the test emphasizes physics combined where necessary with mathematics. Mathematical physicists who may seldom set foot on a glacier, have contributed greatly to the understanding of the subject. In glaciology, as in other branches of science, both the theoretical and the experimental approach should be coordinated; the experiments should be designed to investigate specific problems. (Knapp-USGS)
W70-09412

2D. Evaporation and Transpiration

INFLUENCE OF EVAPORATION FROM LAKE BAIKAL ON PRECIPITATION IN THE SURROUNDING REGIONS,
V. I. Korniyenko.
Translated from Voyeykov Main Geophysical Observatory (Trudy GGO), No 147, p 122-127, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 144-148, 1969. 5 p, 2 fig, 3 tab, 2 ref.

Descriptors: *Evaporation, *Lakes, *Precipitation (Atmospheric), *Climatology, Rainfall disposition, Humidity, Water balance, Winds, Weather, Weather patterns.
Identifiers: *USSR, *Lake Baikal.

Lake Baikal, a large (31,500 sq km) deep-water mountain lake, has a cooling effect on the adjoining regions in summer and a warming effect in winter. The temperature difference between the water surface and the air is 13-15 deg C in December. Owing to the orographic characteristics of the lake shore, this influence cannot reach far beyond the limits of watersheds. The effect of evaporation from Lake Baikal on precipitation in the surrounding regions was computed for the ice-free period from May to December for two years, 1963 with precipitation below normal, and 1965 with precipitation above normal. The contribution of evaporation from the lake to the change in moisture content is extremely small or nonexistent in summer. The influence of evaporation from Lake Baikal is strongest on the southeast shore in November December when evaporation is strong and the moisture content of the air is extremely low. The maximum station increase in precipitation is within 3-5% in October, 13-16% in November, and 10-15% in December. (Knapp-USGS)
W70-09096

AN ENERGY BUDGET STUDY ABOVE THE FOREST CANOPY AT MARMOT CREEK, ALBERTA, 1967,
Meteorological Service of Canada, Calgary (Alberta).
D. Storr, J. Tomlain, H. F. Cork, and R. E. Munn.
Water Resources Research, Vol 6, No 3, p 705-716, June 1970. 12 p, 12 fig, 3 tab, 17 ref.

Descriptors: *Evapotranspiration, *Energy budget, *Forests, Demonstration watersheds, Rainfall-runoff relationships, Solar radiation, Water balance, Convection, Heat transfer, Mass transfer, Photosynthesis, Winds, Diffusivity.
Identifiers: *Marmot Creek Experimental Watershed (Canada), Alberta (Canada).

For a 19-day period in July 1967, daily estimates of evapotranspiration were obtained from hourly calculations of the Bowen ratio above the forest canopy in the Marmot Creek Experimental Watershed, Alberta, Canada. The estimates ranged from 7.9 mm to 1.5 mm. The Bowen ratio was found to be very dependent on wind direction, sky condition, and basin aspect, (which was a significant factor). Although the area is unhomogeneous, the results appear reasonable when compared with other estimates of evapotranspiration. (Knapp-USGS)
W70-09111

ENERGY RELATIONSHIPS IN THE DESIGN OF FLOATING COVERS FOR EVAPORATION REDUCTION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Keith R. Cooley.
Water Resources Research, Vol 6, No 3, p 717-727, June 1970. 11 p, 9 fig, 4 tab, 24 ref.

Descriptors: *Evaporation control, *Reservoir evaporation, Energy budget, Solar radiation, Heat transfer, Evaporation.
Identifiers: Floating covers (Reservoir).

A theoretical analysis of the energy balance equation for a partially covered body of water indicates that surface reflectance for solar radiation and infrared emittance are important properties to consider in designing covers for maximum efficiency in reducing evaporation. White materials satisfy the requirement that both these parameters be as large as possible. Experiments were conducted on insulated evaporation tanks partially covered with foamed wax, lightweight concrete, white butyl rubber, and styrofoam. Several shapes and sizes were tested. The radiative properties of the cover were again noted to be important, and thin covers proved to be slightly more efficient than thick insulated covers. Evaporation reduction was proportional to the percent of surface area covered, the constant of proportionality depending upon the color and type of materials used. For the white, impermeable materials tested, the constant of proportionality was near unity. The reduction in evaporation was also highly correlated with the reduction in net radiation. (Knapp-USGS)
W70-09112

WATER USE BY SALT CEDAR,
Geological Survey, Lubbock, Tex.; and Texas Tech Univ., Lubbock.
T. E. A. van Hylckama.
Water Resources Research, Vol 6, No 3, p 728-735, June 1970. 8 p, 6 fig, 4 tab, 10 ref.

Descriptors: *Evapotranspiration, *Consumptive use, *Tamarisk, Phreatophytes, Evapotranspiration control, Water conservation, Water yield improvement, Clear-cutting, Soil-water-plant relationships, Lysimeters.
Identifiers: Phreatophyte control.

Six years of observations on water use by salt ced conducted in a battery of evapotranspirometers, tanks, have shown that thinned out stands nearly as much water as control tanks if the wate of good quality. It is concluded that the method making a vegetation survey and then extrapolat water use as measured in evapotranspirometers t 100% density can lead to serious overestimation water use. Thinning and cutting are ineffect methods of saving water. In cutoff stands, un favorable conditions, shoots can increase in len by as much as 5 cm per day. Only a few plants su as bamboo and cucumber are reported to gr faster than that. The assumption t phreatophytes always transpire at a potential rat not sustained by the facts presented in this pap When differences in depth to water as small as to 2.1 meters and 2.1 to 2.7 meters affect the wa use, it seems reasonable to conclude that wit water table at four meters for instance (a situat not unusual along dry river beds), salt cedar may thrive but use comparatively little water, the claims as to the quantity of water potenti saved by their eradication could well be overe mated. (Knapp-USGS)
W70-09113

DISPOSAL OF BRINE BY SOLAR EVAPOR TION: FIELD EXPERIMENTS,
New Mexico State Univ., University Park.
C. G. Keyes, Jr., Narendra N. Gunaji, Jesse V. Lunsford, and William D. Loth.
For sale by Supt. of Documents, U.S. Governm Printing Office, Wash., D.C. 20402-Price $1.50 copy. Office of Saline Water Research Development Progress Report No. 563, May 19 166 p, 15 tab, 15 fig, 36 ref, 7 append. OSW C tract No. 14-01-0001-969.

Descriptors: *Brine disposal, *Evaporation, *En gy balance, *Evaporation pans, Solar evaporatio
Identifiers: Evaporation enhancement, Effici dye, Evaporation ponds, Evaporation compu Solar radiation.

Field studies on the determination of evaporat of brine by methods of energy budget, water bud and mass transfer are described. Experiments w performed using insulated pans and ponds at b the Roswell, N. M. Test Facility and the New M ico State University. Although the use of Napht Green enhanced the evaporation rate, the costs evaporation decrease with increasing plant cap ty; however the lowest unit cost for desalted wa and waste disposal by evaporation, is at a capa of 75 MGD. (Rinne-Office of Saline Water)
W70-09150

A DIURNAL DISTRIBUTION FUNCTION F DAILY EVAPORATION,
Commonwealth Scientific and Industrial Resea Organization, Canberra (Australia). Div. of L Research and Regional Survey.
P. M. Fleming.
Water Resources Research, Vol 6, No 3, p 9 942, June 1970. 6 p, 6 fig, 12 ref.

Descriptors: *Mathematical models, *Wa balance, *Evaporation, *Energy budget, *So radiation, Lysimeters, Statistical mod Evapotranspiration.
Identifiers: Daily evaporation patterns.

Some deterministic mathematical models hydrologic processes require an approximate d nal distribution of evaporation. The problem estimating the diurnal distribution of evapora rates is examined when only total daily evapora is given. Two cases are considered, clear days, nondimensional distribution functions developed for each case. Application of the tribution functions requires a knowledge of time of sunrise and daylength. Operating rule decide which distribution function to employ given in terms of alternate data, sunshine ho solar radiation, and daily evaporation. The prel

ary nature of the results is emphasized. (Knapp-USGS)
W70-09205

MONTHLY MEAN SURFACE TEMPERATURES FOR LAKE ONTARIO AS DETERMINED BY AERIAL SURVEY,
Meteorological Service of Canada, Toronto (Ontario).
For primary bibliographic entry see Field 02H.
W70-09206

TRANSPIRATION OF PONDEROSA PINE AND DOUGLAS FIR AFTER TREATMENT WITH PHENYLMERCURIC ACETATE,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 03B.
W70-09207

WATER TRANSPORT IN SOILS BY EVAPORATION AND INFILTRATION,
Rothamsted Experimental Station, Harpenden (England).
D. A. Rose.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 171-181, 1968. 11 p, 6 fig, 1 tab, 20 ref.

Descriptors: *Evaporation, *Soil moisture, *Soil water movement, Percolation, Moisture content, Field capacity, Mathematical studies, Humidity, Drying, Diffusion, Laboratory tests, On-site tests.
Identifiers: Soil water evaporation.

The equation of vertical flow is adapted to describe the evaporation of water from, and the uptake of water by a deep uniform soil free from vegetation. The theory is examined by laboratory measurements on long columns of 0.5 - 1.0 mm aggregates of three soils from Rothamsted and Woburn. Evaporation from soils initially at a uniform moisture content--field capacity--decreases as the square root of time, and causes moisture profiles which differ for each soil. Drying diffusivities calculated from these profiles have an unusual shape, decreasing to a minimum and then increasing as the moisture content falls from field-capacity to air-dryness. The uptake of water treated in the same way yields wetting diffusivities which also display a prominent minimum as moisture content increases from air-dryness to field capacity. (See also W70-09277) (Knapp-USGS)
W70-09276

SOIL TEMPERATURE AND WATER CONTENT CHANGES DURING DRYING AS INFLUENCED BY CRACKS: A LABORATORY EXPERIMENT,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 02G.
W70-09379

MAP OF EVAPORATION FROM SMALL RESERVOIRS OF THE CENTRAL CHERNOZEM PROVINCES,
L. F. Forsh.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic; collection of papers translated for U S Agricultural Research Service p 144-165, 1967. 22 p, 7 fig, 4 tab, 10 ref.

Descriptors: *Evaporation, *Reservoirs, *Lakes, *Ponds, Chernozems, Mapping, Meteorological data, Limnology, Winds, Vapor pressure, Water temperature, Humidity, Seasonal, Air temperature, Statistical methods, Stations.
Identifiers: *USSR, Chernozem Provinces.

Data recorded at the small reservoirs and ponds of Kursk Province, USSR, during the summer months of 1956 to 1960, were analyzed and maps of the monthly evaporations in the Central Chernozen Provinces were drawn. This type of evaporation map must be used only as a guide in obtaining values of surface evaporation from reservoirs in the Central Chernozem Provinces, since in every individual case the values shown on the maps are subject to local conditions. Moreover, the accuracy of calculation of evaporation by using the Forsh (1963) formula lies within a range of 10 percent. The coefficients for converting evaporation to the 3 and 20 percent frequency given in this paper are useful in practical application. (See also W70-09312) (Gabriel-USGS)
W70-09413

2E. Streamflow and Runoff

RUNOFF SYNTHESIS FOR RAIN-ON-SNOW BASIN,
Corps of Engineers, Portland, Oreg. North Pacific Div.
James A. Anderson, and David M. Rockwood.
38th Annu Meet Western Snow Conf, Victoria, Can, Apr 1970. 21 p, 7 fig, 3 tab, 10 ref.

Descriptors: *Watersheds (Basins), Streamflow, *Synthesis, *Synthetic hydrology, Runoff, Rainfall-runoff relationships, *Snowmelt, Hydrology, Snowpacks, Precipitation (Atmospheric), Rainfall.
Identifiers: *SSARR (Acronym), *Hydrologic models, Willamette River Basin, Oreg.

The hydrologic elements and resulting computed runoff for the Willamette Basin Snow Laboratory in Oregon, for 1949-50 and 1050-51, were synthesized using the SSARR (streamflow synthesis and reservoir regulation) model. Results show that the watershed model of the SSARR computer program, when operated in a zonal mode, can adequately represent all hydrologic factors. The program can synthesize streamflow on a continuous basis for rain-on-snow basins, affecting runoff in a completely general manner, and can maintain continuity of the snowpack accumulation and melt throughout winter and spring. The program also can differentiate between the varying conditions of runoff and snowpack on an elevation basis. This is accomplished by subdividing a drainage basin into bands or zones of equal elevation, for which runoff conditions and streamflow conditions are computed individually. (USBR)
W70-09027

EFFECTS OF FOREST CLEAR-FELLING ON THE STORM HYDROGRAPH,
Georgia Univ., Athens.
For primary bibliographic entry see Field 03B.
W70-09117

RECONNAISSANCE OF WATER RESOURCES IN THE HAINES-PORT CHILKOOT AREA, ALASKA,
Geological Survey, Washington, D.C.
James A. McConaghy.
Available free on request to the US Geological Survey, Wash, DC, 20242. US Geological Survey Circular 626, 1970. 16 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Water resources, *Alaska, Water supply, Cities, Surface waters, Groundwater, Water yield, Water quality, Water wells, Water resources development.
Identifiers: Haines (Alaska), Port Chilkoot (Alaska).

The most obvious source of fresh water in the Haines-Port Chilkoot area of Alaska is the Chilkat River. It is nearby, has a dependable flow, and generally has satisfactory chemical quality; however, the river contains glacial flour or suspended silt that causes a milky appearance and which is difficult to remove. Creeks in the area do not have adequate water for dependable public supply. Groundwater is the best source of additional water in the area. There are few wells in the area and consequently groundwater data were sparse. Exploratory auger drilling was the principal method used to obtain new groundwater data. In addition, surface-water supplies were inventoried and water samples were collected for chemical analysis. (Knapp-USGS)
W70-09130

HYDROLOGY OF THE UPPER MALAD RIVER BASIN, SOUTHEASTERN IDAHO,
Geological Survey, Washington, D.C.
E. J. Pluhowski.
For sale by Superintendent of Documents, US Government Printing Office, Wash, DC 20402 - Price $0.45 (paper cover). US Geological Survey Water - Supply Paper 1888, 1970. 89 p, 35 fig, 11 tab, 32 ref.

Descriptors: *Water resources, *Groundwater basins, *Watersheds (Basins), *Idaho, Groundwater, Surface waters, Water yield, Water balance, Water utilization, Irrigation water, Recharge, Discharge (Water), Floods, Rainfall-runoff relationships.
Identifiers: Malad River (Idaho).

The Malad Valley comprises 485 sq mi in the Basin and Range physiographic province. Relief is about 5,000 ft; the floor of the Malad Valley is at an average altitude of about 4,400 ft. The climate is semiarid throughout the Malad Valley and its principal tributary valleys; above 6,500 ft the climate is subhumid. Annual precipitation ranges from about 13 inches in the lower Malad Valley to more than 30 inches on the highest peaks of the Bannock and Malad ranges. Annual water yields in the project area range from about 0.8 inch in the lower Malad Valley to more than 19 inches on the high peaks north and east of Malad City. The mean annual water yield for the entire basin is 4 inches, or about 115,000 acre-feet. Evaporation is greatest in July when about 7 inches is lost from lakes, reservoirs, and waterlogged areas; losses from free-water surfaces may be as much as 38 inches annually. An extensive groundwater reservoir consisting of sand and gravel interbedded with relatively impermeable beds of silt and clay underlies much of the Malad Valley. On the basis of a water-balance analysis, underflow from the project area was estimated to be 28,000 acre-feet annually, surface-water outflow was 51,000 acre-feet, and transbasin imports were about 4,000 acre-feet. The total water yield is not sufficient to meet all the water needs of the basin. A comprehensive water-management plan is required to ensure optimal use of the water resource. (Knapp-USGS)
W70-09132

STREAM ORDER AS A MEASURE OF SAMPLE SOURCE UNCERTAINTY,
South Carolina Univ., Columbia.
For primary bibliographic entry see Field 02J.
W70-09202

TURBULENCE MEASUREMENTS NEAR THE FREE SURFACE OF AN OPEN CHANNEL FLOW,
Illinois Univ., Urbana.
E. R. Holley.
Water Resources Research, Vol 6, No 3, p 960-963, June 1970. 4 p, 3 fig, 6 ref.

Descriptors: *Open channel flow, *Turbulence, *Free surface, Instrumentation, Measurement, Anemometers, Current meters, Model studies, Hydraulic models, Flumes, Calibrations.
Identifiers: Turbulence meters.

Turbulence spectrums were obtained from 0.006 inch to 1 inch below the free surface of an open channel flow with a depth of 6 inches and a mean velocity of 0.93 fps. No significant variation in the spectrums was observed for the different distances below the surface. The data tend to substantiate the presence of turbulence in the region which is sometimes called the surface film in reaeration studies. (Knapp-USGS)

W70-09208

CALIBRATION OF WALNUT GULCH SUPERCRITICAL FLUMES,
Agricultural Research Service, Stillwater, Okla. Soil and Water Conservation Research Div.
Wendell R. Gwinn.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY8, Paper 7479, p 1681-1689, August 1970. 9 p, 4 fig, 2 ref, append.

Descriptors: *Stream gages, *Stage-discharge relations, *Supercritical flow, *Flumes, Alluvial channels, Gaging stations, Model studies, Sediment transport, Flowmeters.
Identifiers: Stream-gaging flumes.

A new supercritical measuring flume is being used to gage sediment-laden ephemeral flows in steep channels. The transition from the natural channel to the straight modified trapezoidal measuring section of the flume consists of a cylindroid surface. The flume is kept free of deposition by a V-shaped floor which slopes in the direction of the flow. The head is measured at the midpoint of the straight section. Ten of these concrete flumes have been installed in the Walnut Gulch Watershed near Tombstone, Arizona. Eight of the flumes have already been calibrated with models in the laboratory. The largest has a bottom width of 120 ft and a capacity of about 26,000 cfs. This structure is the largest known precalibrated flume now in operation. The design of the flumes, the laboratory calibration data and some observations of their field operation are analyzed. (Knapp-USGS)
W70-09218

DISPERSION PREDICTION FROM CURRENT METERS,
Ontario Water Resources Commission, Toronto. Water Quality Surveys Branch.
Mervyn D. Palmer, and J. Bryan Izatt.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY8, Paper 7464, p 1667-1680, August 1970. 14 p, 8 fig, 6 tab, 9 ref, append.

Descriptors: *Dispersion, *Diffusion, *Current meters, *Lake Erie, Forecasting, Hydraulics, Turbulence, Turbulent flow, Correlation analysis, Probability, Path of pollutants.
Identifiers: Turbulence meters.

Two-dimensional dispersion plumes for the near shore area of Nanticoke on Lake Erie are predicted by applying turbulent diffusion concepts to recording current meter data. Eulerian integral time scales are found from autocorrelation coefficients, based on monthly data. Lagrangian integral space scales and one-dimensional diffusion coefficients may be predicted. Average monthly probability distributions are based on north-south and east-west diffusion coefficients. The prediction equation is an average of long and short time diffusion equations. Better dilution is found near the shore and parallel to it. It is assumed that vertical diffusion is negligible, that the Reynold's number is large, and that the effective diffusion coefficients are constant over long periods. (Knapp-USGS)
W70-09219

FLOOD OF AUGUST 1969 IN VIRGINIA,
Geological Survey, Richmond, Va.
J. D. Camp, and E. M. Miller.
US Geological Survey Open-file report, 1970. 120 p, 31 fig, 1 plate, 4 tab.

Descriptors: *Historic flood, *Virginia, *Hurricanes, *Cloudbursts, *Flood damage, Stage-discharge relations, Rainfall-runoff relationships, Precipitation (Atmospheric), Storm runoff, Water levels, Hydrographs, Landslides, Erosion, Sedimentation.
Identifiers: Hurricane Camille (1969).

Hurricane Camille became a tropical depression and soaked central Virginia with up to 28 inches of rain during the night of August 19th and morning of the 20th, 1969. The rains, flash floods, and rain-induced landslides accompanying the storm's passage have been called the worst natural disaster ever to strike Virginia. Discharge of streams in the James, Potomac, Rappahannock, and York River basins exceeded previous known maximums. At Tye River near Lovingston the peak flood discharge was eight times the previous high during the 31 years of record. James River stations downstream from the Maury River recorded peak flows of greater than 100-year recurrence interval. As of Nov. 13, 1969, the State had counted 113 dead and 102 injured with 39 persons still missing. The total damage amounted to over $116 million. This report provides hydrologic data needed for planning and design. The report includes a general description of the flood; precipitation information; sediment aspects of the flood; and records of stage and/or discharge for 105 sites. (Knapp-USGS)
W70-09234

WATER BUDGET OF UPPER KLAMATH LAKE SOUTHWESTERN OREGON,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02H.
W70-09250

FLOODS IN IOWA,
Geological Survey, Iowa City, Iowa.
Harlan H. Schwob.
In: Flood Plain Management - Iowa's Experience, Papers presented at Conference on Flood Plain Management, 6th Water Resources Design Conference, Jan 23-25, 1968, Iowa State University; published by Iowa State University Press, Ames, p 27-35, 1969. 9 p, 3 fig, 12 ref.

Descriptors: *Floods, *Iowa, *Rainfall-runoff relationships, Flood forecasting, Flood protection, Flood damage, Flood plains, Statistics, Statistical methods, Historic flood, Maximum probable flood.
Identifiers: *Mean annual flood.

The greatest floods recorded in Iowa are listed, analyzed, and discussed. Multiple regression analysis was made of the flood data for Iowa rivers. This resulted in the division of the state into two hydrologic regions, with a formula being developed for each region permitting the mean annual flood (MAF) to be computed. The variables include drainage area, stream slope, and for most of the state the normal annual precipitation. The mean annual flood is described quantitatively as the mean of the annual flood peak discharges that would be derived from a very long streamflow record. The use of the mean annual flood to help define outstanding flood discharges is an attempt to place the data for different areas of the state on a common basis. The flood data presented serve to point out the potential and the extent of major floods known to have occurred within Iowa. These data can be used to assist in planning programs for flood plain management. (See also W70-09253). (Knapp-USGS)
W70-09254

COASTAL WETLANDS OF VIRGINIA-INTERIM REPORT,
Virginia Inst of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02L.
W70-09350

A PROPOSED STREAMFLOW DATA PROGRAM FOR MAINE,
Geological Survey, Augusta, Maine.
For primary bibliographic entry see Field 07A.
W70-09353

A NOTE ON THE ESTIMATION OF THE PARAMETERS IN LOGARITHMIC STAGE-DISCHARGE RELATIONSHIPS WITH ESTIMATES OF THEIR ERROR,
C. Venetis.
Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 105-111, June 1970. 7 p, 1 fig, 1 tab, 7 ref.

Descriptors: *Stage-discharge relations, *Statistical methods, *Estimating, Regression analysis, Streamflow forecasting, Open channel flow, Channel morphology, Discharge coefficients, Least squares method, Water levels.
Identifiers: Graphic estimation methods.

Under certain assumptions the stage-discharge relationship of a channel cross-section can be approximated by a logarithmic relationship. Observational pairs of stage and discharge plotted on log-log paper often cluster around a straight line and this suggests that the assumptions involved are often approximately satisfied. In such cases the parameters of the logarithmic relationship are usually estimated graphically from the position and slope of the straight line on the log-log paper. In this paper principles and methods are outlined for the estimation of the parameters with estimates of their standard error, via regression analysis. Because the water level of zero flows is usually one of the unknown parameters, the regression is non-linear and least squares optimal estimates can be obtained by a step-by-step approximation. The variances of the parameter estimates can be obtained from the dispersion matrix of the joint distribution of the least squares estimators via the likelihood function. An estimate of the error in predictions of the discharge depending on the corresponding stage may be obtained. (Knapp-USGS)
W70-09374

HYDROLOGICAL SERIES AS A BASIS FOR WATER RESOURCES POLICY,
Technische Hochschule, Munich (West Germany).
For primary bibliographic entry see Field 06A.
W70-09387

TURBIDITY OF RIVERS AND ITS DISTRIBUTION IN THE CENTRAL CHERNOZEM PROVINCES,
For primary bibliographic entry see Field 02J.
W70-09416

FLOOD SERIES FOR GAGED PENNSYLVANIA STREAMS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
B. M. Reich.
Available from NTIS as PB-193 704, $3.00 in paper copy, $0.65 in microfiche. Institute for Research on Land and Water Resources, Research Publication No. 63, University Park, Pa., Dec. 1969. 83 p, 1 tab, 5 fig, 21 ref. OWRR Project A-016-PA (1).

Descriptors: *Stream gages, *Stream flow, *Water year, *Return flow, *Watershed management, Gaging stations, Pennsylvania, Flood forecasting, Frequency analysis, Social aspects.
Identifiers: *Horizontal asymptote, *Gumbel paper, *Except outlier, Weibull formula, Extreme events, Flood frequency curve, Return period.

Modern analyses of flood records for 84 locations on Pennsylvania streams are presented for engineering practitioners to judge for fit to three mathematical curves. Extreme value plots report the greatest instantaneous peak discharge for each water year. Floods are arranged in order of magnitude for each watershed and plotted as points on extreme value paper. Exact locations to which the data apply are described. For each plot the following information is given: major river basin in which each stream is located, stream name, area in square miles of each topographic drainage basin, number of years of data available, mean of the annual series of floods in cubic feet per second, standard deviation of the annual series in cfs, and coefficient of skewness of the logs (to base 10) of the annual series values. Practitioners are asked to judge the general trend of the observed flood curves and rate

em as to fit for Gumbel lines, Log-Gumbel rves, or Log-Pearson Type III curves. Judgments to whether a horizontal asymptote will ultimately reached and also for except outliers are also quested. Questionnaires are included in the blication. Results from these questionnaires will analyzed anonymously and submitted for publi-tion in a technical journal where hydrologists can press their opinions in printed discussions. (Sink-nn State Univ)
70-09420

F. Groundwater

REDICTIONS OF RESERVOIR LEAKAGE,
ames and Moore, San Francisco, Calif.
eorge D. Roberts.
ll Assn Eng Geol, Vol 6, No 1, p 70-82, Spring 69. 13 p, 3 fig, 5 ref.

escriptors: *Reservoirs, Reservoir design, Reser-ir construction, *Reservoir leakage, *Reservoir rveys, *Water table, Reconnaissance surveys, ngineering geology, Geologic investigations, Sub-rface investigations, Geologic mapping, Observa-n wells, Groundwater flow, Groundwater geolo-, Groundwater, Leakage, Hydrogeology, Dams.
entifiers: Reservoir modifications, Groundwater stem, Norfork Dam (Ark), Clearwater Dam Mo), Hawthorne Reservoir (Nev), Seepage con-l.

study of groundwater conditions within and ad-cent to a proposed reservoir is an initial require-ent of investigations for constructing a dam. asic principles for a reservoir groundwater study e illustrated by case histories. The relationships etween the natural groundwater level and akage, and subsurface hydraulic effects caused by reservoir are discussed. The groundwater survey ould include map study; field reconnaissance; view of literature; and field measurements of ater wells, flow from springs, chemical analysis, nd groundwater flow rates. The cost of a ground-ater study is low and is an investment that yields a gh return in terms of trouble and expenses oided. Because of the usual initial slow rate of roundwater adjustment to new reservoirs, studies ould continue during the first several years of eservoir operation to detect changes in water vels that could develop into leakage. (USBR)
70-09046

ETHOD FOR COMPUTING GROUNDWATER EVEL FLUCTUATIONS,
V. Vol'ftsun.
ranslated from State Hydrologic Institute (Trudy GI), No 165, p 128-147, 1969. Soviet Hydrology: elected Papers, Issue No 2, p 115-130, 1969. 16 p, fig, 4 tab, 2 ref. 3 append.

escriptors: *Water level fluctuations, *Ground-ater, *Water balance, *Hydrologic budget, Infil-ration, Precipitation (Atmospheric), Recharge, vapotranspiration, Discharge (Water), Ground-ater movement, Water table, Surface-ground-ater relationships.
dentifiers: Groundwater-level fluctuations.

A water balance method can be used to calculate roundwater-level fluctuations during the growing eason. For coarse-texture soils and a groundwater epth of about 1.5 m, when the seepage time of recipitation through the aeration zone is 1 day or ess, when there is no backwater from rivers or akes, and no water exchange between aquifers, the nethod of computation described can be used to recalculate the groundwater level one day in ad-ance. It can also be used to predict fluctuations of low over a long period preceding a given data, rom precipitation, air moisture deficit, and wind speed data. It is possible to determine the effect of uman activity, such as for example, the planting of orests, various agricultural practices, etc., on groundwater level regime and surface runoff in the catchment. (Knapp-USGS)
W70-09103

NUMERICAL MODELING OF UNSATURATED GROUNDWATER FLOW AND COMPARISON OF THE MODEL TO A FIELD EXPERIMENT,
Kansas Univ., Lawrence, and Geological Survey, Garden City, Kans.
Don W. Green, Hassan Dabiri, Charles F. Weinaug, and Robert Prill.
Water Resources Research, Vol 6, No 3, p 862-874, June 1970. 13 p, 13 fig, 2 tab, 19 ref. OWRR Project B-018-KAN.

Descriptors: *Groundwater movement, *Soil water movement, *Surface-groundwater relationships, *Unsaturated flow, *Mathematical models, Computer models, On-site tests, Wetting, Drying, Pit recharge, Ponds, Recharge, Percolation, Numerical analysis, Porous media.
Identifiers: 2-phase flow (Soil water).

A mathematical model describing isothermal, two-phase flow in porous media consists of differential equations, using algorithms for their numerical solution. It was applied to the problem of vertical groundwater movement in unsaturated soils in the absence of evaporation and transpiration. The equations describing water-air flow through porous media are second order, nonlinear partial differential equations. These equations were converted to finite difference form and were solved with the aid of a digital computer using an iterative implicit procedure. The model includes effective permeabilities of each phase and capillary pressure as functions of liquid saturation. The properties of the porous media may be varied in the model as functions of position. A comparison was made between computed results and experimental field data on moisture movement beneath a shallow surface pond. Water was added to the pond at controlled rates to maintain an approximately constant head for a set time period. Following this wetting period the pond was kept dry, but covered to reduce evaporation. The experiment was simulated with the computer model and excellent agreement between calculated results and the data was obtained. (Knapp-USGS)
W70-09107

TWO-DIMENSIONAL DISPERSION EXPERIMENTS IN A POROUS MEDIUM,
California Univ., Santa Barbara.
John C. Bruch, Jr.
Water Resources Research, Vol 6, No 3, p 791-800, June 1970. 10 p, 7 fig, 1 tab, 9 ref.

Descriptors: *Dispersion, *Porous media, *Groundwater movement, Convection, Seepage, Mixing, Flow, Density, Viscosity, Model studies, Hydraulic models, Laboratory tests.
Identifiers: Two-dimensional dispersion.

A series of two-dimensional dispersion experiments were performed in a one-and-two-layered porous medium. The experimental results were compared with a theoretical and a numerical solution both of which describe the two-dimensional dispersion of a miscible, second fluid through a unidirectional, seepage flow. The combined effect of longitudinal and lateral dispersion was considered in all cases. The experimental results and their comparisons with the numerical values clearly demonstrate the need to consider the combined effect of longitudinal and lateral dispersion in the analysis of the propagation of a miscible fluid in groundwater flow. If lateral dispersion were not considered, there would be no salt concentration at the position discussed. These, as well as the other results presented, also verify the use of the theoretical solution and the numerical scheme as accurate models for the two-dimensional dispersion phenomenon. (Knapp-USGS)
W70-09123

POST-IRRIGATION MOVEMENT OF SOIL WATER: 1. REDISTRIBUTION,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02G.
W70-09124

THE PROTECTION OF GROUNDWATER RESOURCES.
National Water Well Association, Columbus, Ohio.

Water Well Journal, Vol 24, No 7, Special Issue, p 31-33, July 1970. 3 p.

Descriptors: *Water resources development, *Water management (Applied), *Water pollution sources, *Water pollution control, Water pollution treatment, Reviews, Surveys, Bibliographies, Publications, Legislation, Water law.
Identifiers: Groundwater resource protection.

Groundwater resources protection, development, pollution, and legislation are discussed in a comprehensive review article. The topics separately discussed include groundwater protection, groundwater availability, groundwater uses, classification of pollutants, surface pollution sources, pollution from production wells, pollution from injection wells, purification of polluted groundwater, state and federal legislation, and management. (Knapp-USGS)
W70-09127

RECONNAISSANCE OF WATER RESOURCES IN THE HAINES-PORT CHILKOOT AREA, ALASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-09130

HYDROLOGY OF THE UPPER MALAD RIVER BASIN, SOUTHEASTERN IDAHO,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-09132

A NUMERICAL TECHNIQUE FOR CALCULATING THE TRANSIENT POSITION OF THE SALTWATER FRONT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W70-09196

DIGITAL ANALYSIS OF AREAL FLOW IN MULTIAQUIFER GROUNDWATER SYSTEMS: A QUASI THREE-DIMENSIONAL MODEL,
Geological Survey, Washington, D. C.
J. D. Bredehoeft, and G. F. Pinder.
Water Resources Research, Vol 6, No 3, p 883-888, June 1970. 6 p, 5 fig, 11 ref.

Descriptors: *Groundwater movement, *Aquifers, *Mathematical models, Computer programs, Equations, Numerical analysis, Aquicludes, Leakage, Permeability, Artesian wells, Water storage, Water table.
Identifiers: Multiaquifer systems, Leaky artesian aquifers.

A general solution for the response of multiple aquifer systems to pumping stress requires solving the three-dimensional flow equations. The large number of arithmetic calculations and the excessive computer storage required for a numerical solution usually precludes solving the equations in three dimensions for typical hydrologic problems. When the hydrologic system is represented by aquifers in which flow is assumed horizontal, and confining layers in which flow is assumed vertical, the problem can be reduced to solving two-dimensional equations for each aquifer, the aquifers being coupled through leakage. An iterative scheme is used to solve simultaneously the finite difference equations describing the response of confined and unconfined aquifers with or without storage in the confining layer. (Knapp-USGS)
W70-09197

FINITE ELEMENT METHOD OF ANALYZING STEADY SEEPAGE WITH A FREE SURFACE,
California Univ., Berkeley.
For primary bibliographic entry see Field 02G.
W70-09198

A MOVING BOUNDARY MODEL OF A ONE-DIMENSIONAL SATURATED-UNSATURATED, TRANSIENT POROUS FLOW SYSTEM,
Stanford Univ., Calif.
For primary bibliographic entry see Field 02G.
W70-09199

FINGER IMBIBITION IN ARTIFICIAL REPLENISHMENT OF GROUNDWATER THROUGH CRACKED POROUS MEDIUM,
Maharaja Sayajirao Univ. of Baroda (India).
A. P. Verma.
Water Resources Research, Vol 6, No 3, p 906-911, June 1970. 6 p, 3 fig, 20 ref.

Descriptors: *Groundwater movement, *Injection wells, *Mathematical models, *Mixing, Saline water intrusion, Porous media, Fractures (Geology), Permeability, Immiscibility, Viscosity, Water properties, Wettability, Wetting.
Identifiers: Imbibition (Groundwater).

A theoretical model of groundwater replenishment in a cracked porous medium considers simultaneous occurrence of the phenomena of fingering and imbibition. Injection of water into other water bodies is initiated by imbibition, and the injected and native water form two immiscible liquid phases of different salinities with small viscosity difference. For the average behavior of fingering, the nonlinear differential equation is solved by a perturbation technique. An expression for the average cross-sectional area occupied by fingers was obtained. (Knapp-USGS)
W70-09200

GROUNDWATER DISCHARGE IN THE ILLINOIS BASIN AS SUGGESTED BY TEMPERATURE ANOMALIES,
Illinois State Geological Survey, Urbana.
Keros Cartwright.
Water Resources Research, Vol 6, No 3, p 912-918, June 1970. 7 p, 6 fig, 1 tab, 23 ref.

Descriptors: *Groundwater movement, *Discharge (Water), *Illinois, *Geothermal studies, Borehole geophysics, Heat flow, Temperature, Thermal conductivity, Recharge, Groundwater basins, Hydrologic budget, Fractures (Geology), Hydrogeology.
Identifiers: Illinois Basin.

Areas where groundwater in the illinois basin is moving vertically should be reflected by temperature anomalies. An isothermal map for a depth of 500 feet was constructed, based on bottom hole temperature of deep wells. This map was compared with a theoretical isothermal map for a depth of 500 feet that was made by projecting temperature gradients calculated from the thermal conductivities of the rock downward. The residual temperature map shows several warm and cool anomalies that are postulated to be discharge and recharge areas, respectively. Analysis of the curvature of the earth's thermal profile suggests that approximately 59,000 acre-feet of groundwater per year are discharged upward from the deep rocks in the Illinois basin. This figure is of the same magnitude as an estimated excessive groundwater discharge into the region's streams of 43,000 acre-feet. From a simplified model of the basin, a groundwater inflow of about 36,500 acre-feet from the surrounding highlands is estimated. A significant portion of discharge must be through fracture zones associated with faults and anticlines. One discharge area in southwestern Illinois is also suggested by field data. (Knapp-USGS)
W70-09201

ELECTROLYTIC MODEL STUDY FOR COLLECTOR WELLS UNDER RIVER BEDS,
New Mexico Inst of Mining and Technology, Socorro.
Bruce E. Debrine.
Water Resources Research, Vol 6, No 3, p 971-978, June 1970. 8 p, 7 fig, 11 ref.

Descriptors: *Induced infiltration, *Water yield, *Groundwater movement, *Surface-groundwater relationships, *Analog models, Alluvial channels, Discharge (Water), Flow, Model studies.
Identifiers: Electrolytic models.

Analytical solutions of flow to collector wells are based on the assumption of uniform flux distribution along the laterals. Although theoretically the head, and not the flux, should be uniform, these solutions have been claimed closely to approximate the drawdown in the collector well. To test the validity of this claim, the flow to a well with a single lateral, located under a river bed and along which the head is maintained uniform, is reproduced by an electrolytic model. The results of this model study agree rather well with the solutions of Hantush and Papadopulos, the relative deviation being about 2.2%. It is concluded that these solutions adequately describe the drawdown in a collector well. The study further suggests that the flow to a collector well can be treated, using the assumption of either uniform flux or uniform head along the laterals. (Knapp-USGS)
W70-09210

SUMMARY OF GROUNDWATER OCCURRENCE IN CALIFORNIA,
Geological Survey, Menlo Park, Calif.
Fred Kunkel.
U S Geological Survey Open-file report, March 17, 1970. 7 p, 1 map.

Descriptors: *Groundwater, *California, *Hydrogeology, *Reviews, Surveys, Aquifers, Water sources, Alluvium, Mapping, Maps, Hydrologic data, Water yield, Water quality, Geology.

In California most of the readily available groundwater that is pumped from wells occurs in Cenozoic nonmarine sedimentary rocks and alluvial deposits. These deposits fill most of the larger and many of the smaller structural basins. Brief statements are given to summarize groundwater occurrence for all the formations shown on the 'Geologic map of California.' (Knapp-USGS)
W70-09214

WATER-LEVEL AND WATER-QUALITY TRENDS IN AQUIFERS ALONG THE MISSISSIPPI GULF COAST, 1970,
Geological Survey, Jackson, Miss.
Donald E. Shattles, and James A. Callahan.
U S Geological Survey open-file report, July 1970. 19 p, 7 fig, 4 tab, 10 ref.

Descriptors: *Groundwater, *Aquifers, *Fresh water, *Mississippi, *Water-level fluctuations, Water quality, Hydrographs, Artesian wells, Confined water, Saline water intrusion.
Identifiers: Gulf coast, Water quality trend.

Artesian water levels along the Mississippi coast are declining 0.5 to 1.0 foot per year on the average; however, water levels are still above or only slightly below land surface in most places, and considerable additional drawdown is economically available. The groundwater is of good quality except in a few localities where the concentration of chloride exceeds 250 mg/liter. Of the 43 wells that were resampled during 1969, 18 showed a decrease in chloride, 18 showed an increase, and 7 indicated no change. (Lang-USGS)
W70-09223

COMMON ERRORS IN DEVELOPING A GROUNDWATER AQUIFER,
Geological Survey, Louisville, Ky. Water Resources Div.
D. V. Whitesides.
Groundwater, Vol 8, No 4, p 25-28, July-August 1970. 4 p, 8 fig.

Descriptors: *Water resources development, *Groundwater, *Kentucky, *Alluvial channels, *Surface-groundwater relationships, Conjuncti use, Induced infiltration, Ohio River, Aquife Groundwater movement, Planning, Water manag ment (Applied).
Identifiers: Groundwater development.

Some of the more common errors made in t development of groundwater supplies in the allu al aquifers along the Ohio River in Kentucky a discussed. Ample available literature on prop methods of development of the alluvial aquife generally seems to have been ignored by the wat users in the area. The more common errors made the typical developments are singled out for discu sion. In the typical development the aquifer treated as an inexhaustible underground rive Wells generally are clustered in small areas remo from the Ohio River, and are likely to be locat more for convenience and economy of pipeline property access than for hydrologic consideration It is hoped by highlighting these errors and showi alternative methods of development that prop development practices will be fostered. Stages the development of two hypothetical groundwat aquifers in the Ohio River valley are shown by eig illustrations that stress the common errors made development and alternative methods of develo ment taking into account hydrologic consider tions. (Knapp-USGS)
W70-09225

AQUIFER SIMULATION ON SLOW TIME RESISTANCE-CAPACITANCE NETWORKS,
Birmingham Univ. (England). Dept. of Civil E gineering.
K. R. Rushton, and R. G. Bannister.
Groundwater, Vol 8, No 4, p 15-24, July-Augu 1970. 10 p, 11 fig, 1 tab, 5 ref, append.

Descriptors: *Simulation analysis, *Analog model *Groundwater movement, Analog computer Computer models, Instrumentation, Computer Model studies, Resistance networks.
Identifiers: Slow-time analog models.

Resistance-capacitance networks are used to simu late aquifers; most reported work is concerned wit fast time analogs in which the period under co sideration is represented in microseconds. Hov ever the alternative slow time analog has many ad vantages since the electrical experiment take several seconds. This results in simpler equipmen and simpler experimental techniques. Practic aspects of the slow time analog are discussed, wit details given of the components, of simulating wel and recharge, and of measuring instruments. Th techniques are illustrated by a simplified exampl (Knapp-USGS)
W70-09226

GROUNDWATER VELOCITY PARTITION,
Montana State Univ., Bozeman. Dept. of Eart Sciences.
Darrel E. Dunn.
Groundwater, Vol 8, No 4, p 14, July-August 197 1 p.

Descriptors: *Groundwater movement, *Velocity Transmissivity, Aquifers, Water levels, Water ta ble, Recharge, Flow, Discharge (Water).
Identifiers: Groundwater velocity.

The true velocity of groundwater at a point in th groundwater system may be expressed as the sur of a number of partial velocities. Each partia velocity may be defined as a velocity which result from the presence of specific features of the con figuration of the water table. Partial velocities ma be used to facilitate the discussion of groundwate flow systems and associated phenomena. (Knapp USGS)
W70-09227

PUMPING TESTS AND HYDROGEOLOGICAL INVESTIGATIONS OF AN ARTESIAN AQUIFER NEAR HORSENS, DENMARK,
Geological Survey of Denmark, Copenhagen.

..J. Andersen, and Z. Haman.
Nordic Hydrology, Vol 1, No 2, p 69-110, 1970. 42), 10 fig, 13 tab, 14 ref.

Descriptors: *Aquifers, *Glacial drift, *Confined water, *Theis equation, Clays, Sands, Unsteady flow, Artesian wells, Drawdown, Groundwater movement, Permeability, Transmissivity.
Identifiers: *Denmark, Jacobs equation, Aquifer testing.

In the Egebjerg area, near Horsens, Denmark several aquifers consist of glacial outwash material in a glacial buried valley in the Tertiary formation. The lowest of these, which is the main productive aquifer, and which has leaky artesian conditions, varies in thickness from 10-40 m. The lower confining bed consists of boulder clay or meltwater clay underlain by boulder clay. The upper confining bed, where leakage occurs, consists of meltwater clay with thickness from 0 to 5 m. The upper meltwater deposits include a sequence of interglacial lake deposits and several layers or laminae of clay, which separate this water-bearing material into more aquifers. The Theis modified non-equilibrium equation and its derived formula for the non-steady-state leaky artesian case were used to determine aquifer properties from pumping test data. By means of Jacob's method and a logarithmic method, well characteristics are determined graphically. Barometric efficiency, reverse fluctuations, and boundary conditions are recorded and discussed. (Knapp-USGS)
W70-09237

RECONNAISSANCE OF THE GROUNDWATER RESOURCES OF THE MISSOURI RIVER ALLUVIUM BETWEEN MIAMI AND KANSAS CITY, MISSOURI,
Geological Survey, Washington, D.C.
L. F. Emmett, and H. G. Jeffery.
For sale by US Geological Survey, Washington, DC - Price $0.50. US Geological Survey Hydrologic Investigations Atlas HA-344, 1 sheet, 1970. Text, 3 fig, 1 tab, 19 ref.

Descriptors: *Water resources, *Groundwater, *Alluvium, *Missouri River, *Missouri, Water wells, Aquifers, Water yield, Water quality, Water utilization, Water resources development.
Identifiers: Missouri River alluvium.

The purpose of this 1-sheet hydrologic atlas is to describe the thickness, areal extent, and lithology of the alluvial deposits along the Missouri River between Miami and Kansas City, Mo., and to provide information on the occurrence, availability, use, and chemical quality of the water contained in the alluvial aquifer. Flood-plain width varies from 2 to 10 miles and has a total surface area of approximately 440 square miles. Underlying the flood plain are clay, silt, sand, and gravel deposited by the river. The saturated sand and gravel, which is hydraulically connected with the river, constitutes a large and productive aquifer, which for the most part is presently underdeveloped. Eleven cities pump approximately 13.6 million gallons of water per day from the alluvial aquifer in this reach of the river. Industrial use of groundwater is confined to the Kansas City area and amounts to about 13 mgd (million gallons per day). A rough approximation of water used for irrigation is about 1.25 mgd; combined municiple, industrial, and irrigation use amounts to about 28 mgd; 85 percent of this is pumped from the alluvium between Kansas City and Independence. Irrigation wells in the area have reported pumping rates of around 1,000 gpm, and specific capacities ranging from 50 to 150 gpm per foot of drawdown. Water in alluvium in this reach of the valley is a calcium bicarbonate type, characterized by a high hardness and high iron content. (Knapp-USGS)
W70-09249

THE THREE-PHASE DOMAIN IN HYDROLOGY,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
C. H. M. van Bavel.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 23-32, 1968. 10 p, 19 ref.

Descriptors: *Unsaturated flow, *Saturated flow, *Porous media, *Groundwater movement, *Soil water movement, Permeability, Hydraulic conductivity, Porosity, Hydrogeology, Hydrology, Infiltration, Percolation, Discharge (Water), Recharge, Aquifers, Soils, Soil water, Groundwater.
Identifiers: *Multiphase flow (Porous media).

The importance of the unsaturated zone relative to the hydrologic cycle as a whole is considered. The domain of unsaturated water movement is distinguished as a 3-phase system in order to stress the point that its essential characteristics derive from a time-variant proportion of gas and liquid in a solid matrix. This proportion changes as infiltration alternates with drainage and redistribution of water and as recharge is offset by evaporation and transpiration. The water content of the matrix determines the mobility of the liquid phase and the direction and magnitude of the resultant driving forces acting per unit mass of water. Prediction of the behavior of unsaturated systems by either mathematical, numerical, modeling or analog methods is instructive but often too idealized. Practical progress must also lean heavily upon systematic observation of water content and water potential in the zone reaching from the surface to the domain of saturation and of maximum hydraulic conductivity. Many hydrological field studies are completely lacking in this respect. Yet, a number of important hydrologic processes, such as surface exaporation, surface or overland runoff, transpiration by vegetation, interflow and accretion by groundwater reservoirs, are significantly influenced by the physical disposition of the unsaturated zone toward water movement. From a combination of theory and measurement in this area, the behavior of hydrological systems with regard to water yields, stream flow characteristics, and transport and emergence of pollutants, ought to become better understood and more successfully controlled. (See also W70-09261). (Knapp-USGS)
W70-09260

VALIDITY CONDITIONS OF THE POINT DILUTION METHOD,
Academia R. P. R., Bucharest.
E. Gaspar, and M. Oncescu.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 256-263, 1968. 8 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Groundwater movement, *Measurement, *Tracers, *Tracking techniques, Calibrations, Radioisotopes, Nuclear meters, Instrumentation, Boreholes, Water level fluctuations.
Identifiers: *Point dilution tracer methods.

Methods for measuring groundwater movement using instrumented wells and tracer studies are discussed. The field techniques and difficulties of using the point dilution method are explained, and correction factors are tabulated. The effects of drilling on the hydrodynamic fields of aquifers are summarized briefly. (See also W70-09285) (Knapp-USGS)
W70-09284

GROUNDWATER BASIC DATA, PART 2 OF GEOLOGY AND GROUNDWATER RESOURCES OF MERCER AND OLIVER COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, N. Dak.
M. G. Croft.
North Dakota Geological Survey Bulletin 56 and North Dakota Water Commission Groundwater Studies 15, 1970. 268 p, 2 fig, 1 plate, 6 tab, 11 ref.

Descriptors: *Groundwater, *Water resources, *North Dakota, Data collections, Hydrologic data, Hydrogeology, Water wells, Water quality, Sampling, Springs, Water levels, Observation wells, Particle size, Aquifers.
Identifiers: Mercer County (ND), Oliver County (ND).

Data were collected to be used to: (1) determine the location, extent, and nature of the major aquifers of Mercer and Oliver Counties, North Dakota; (2) evaluate the occurrence and movement of groundwater, including the sources of recharge and discharge; (3) estimate the quantities of water stored in the aquifers; (4) estimate the potential yields to wells tapping to major aquifers; and (5) determine the chemical quality of the groundwater. The information in this report was collected chiefly between 1966 and 1969, and consists of the following: (1) Data on about 1,300 wells and test holes; (2) data on 9 springs; (3) water-level measurements in 29 observation wells; (4) logs of 299 test holes and selected wells; (5) chemical analyses of 160 water samples, and (6) 25 particle-size distribution curves. (Knapp-USGS)
W70-09367

TIDAL PHENOMENA IN THE KARSTIC WATER LEVEL,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Maucha, and I. Sarvary.
Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 39-45, June 1970. 7 p, 5 fig, 3 ref.

Descriptors: *Springs, *Karst, *Water level fluctuations, *Siphons, *Tides, Tidal effects, Discharge (Water), Water circulation, Water levels, Aquifers, Groundwater movement.
Identifiers: Earth tides.

In the north-eastern part of Hungary, in the vicinity of the Josvafo Karst Research Station, there are two karstic springs with siphonal discharge. On the basis of the periodicity of discharge, it can be assumed that water yield may be influenced by tidal phenomenon in the karstic water level. Systematic measurements and interpretations have proved the correctness of this assumption. The narrowing and widening of the conduits of the aquifers was measured simultaneously with spring strain gages. A close relationship was found to exist between the variation of gravity and the changes in the size of the openings. Information was obtained on tidal phenomena in the solid crust. The influence of the variation of the gravitation field can also be shown to have affected the yield of non-siphonal karstic springs. (Knapp-USGS)
W70-09368

HYDROLOGICAL ANALYSIS OF VOLCANIC TERRANE: LOWER BASIN OF THE RIO GRANDE DE SAN MIGUEL, EL SALVADOR,
Food and Agriculture Organization of the United Nations, Kingston (Jamaica).
For primary bibliographic entry see Field 03B.
W70-09370

ON THE SOLUTION OF INVERSE PROBLEMS IN HYDROGEOLOGY (FRENCH),
SCET/Cooperation--BCA, Puteaux (France).
A. Korganoff.
Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 67-78, June 1970. 12 p, 2 ref.

Descriptors: *Model studies, *Transmissivity, *Storage coefficient, *Aquifers, Groundwater movement, Mathematical models, Computer models, Networks, Mathematical studies, Systems analysis, Flow nets.
Identifiers: Inverse hydrologic problem.

The inverse problem consists of the determination of the transmissivity and the storage of an aquifer at every point of a net. The equations of the problem are generally undetermined and smoothing condi-

tions are usually introduced. Two other types of constraints are considered: knowledge of the transmissivity, and the storage of points and in regions of equal values. Several different solutions are given according to the relative importance of each constraint, and according to the selected norm. In the case of the Euclidean norm, solutions can be expressed very simply by means of pseudo-inverses. (Knapp-USGS)
W70-09371

ESTIMATING STORAGE CAPACITY IN DEEP ALLUVIUM BY GRAVITY-SEISMIC METHODS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
D. E. Wallace, and D. P. Spangler.
French resume. Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 91-104, June 1970. 14 p, 9 fig, 2 tab, 13 ref.

Descriptors: *Water storage, *Alluvium, *Aquifers, *Seismic studies, *Gravity studies, Storage coefficient, Groundwater basins, Sedimentary basins (Geological), Exploration, Surveys, Investigations, Arizona, Water resources development.
Identifiers: Basin and Range region, Groundwater prospecting.

Large volumes of groundwater are contained in the deep intermontane valleys of Basin and Range regions. Determining the shape and storage capacity of these basins by drilling can be expensive and difficult because of the depth of alluvium and large areas involved. These difficulties can often be overcome by combining gravimetric and seismic refraction interpretations. The basin boundaries are determined by gravimetric methods, with bulk density samples taken of all representative formations. Density values can then be correlated with seismic velocities to estimate subsurface porosities. Seismic velocity varies inversely with porosity for the alluvial deposits. These values can be correlated with their respective formations in the basin from geologic sections derived from the seismic refraction survey. Thus, with volume and porosity of the alluvium known, storage capacity (both present and potential) can be computed. (Knapp-USGS)
W70-09373

DETERMINATION OF THE VELOCITY AND DIRECTION OF GROUNDWATER FLOW BY RADIOISOTOPES,
Middle Eastern Regional Radioisotope Center for the Arab Countries, Cairo (Egypt).
I. B. Hazzaa.
French resume. Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 11-15, June 1970. 5 p, 1 fig, 1 tab, 9 ref.

Descriptors: *Groundwater movement, *Tracers, *Tracking techniques, *Iodine radioisotopes, Observation wells, Sampling, Monitoring, Permeability, Velocity, Radioisotopes, Radioactivity techniques, Aquifers, Transmissivity, Porosity.
Identifiers: Groundwater tracers, Aquifer testing.

A tracer method was developed for determination of the velocity and direction of groundwater flow. Derived theoretical considerations together with model basin experiments verify this method. For this purpose, a pumped well and two piezometers were used. A proper quantity of the radioisotope I-131 was injected in the first piezometer and moved with groundwater flow. Pumping was started and the time of arrival of I-131 in the pumped water was recorded. The pumping rates, the aquifer dimensions and the effective porosity and can be calculated. (Knapp-USGS)
W70-09386

MINING AND GROUNDWATER GEOPHYSICS/1967.
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 07B.
W70-09392

GEOPHYSICS IN PROSPECTING AND EXPLORATION FOR MINERAL DEPOSITS IN THE U.S.S.R.,
Ministerstvo Geologii, Moscow (USSR).
For primary bibliographic entry see Field 07B.
W70-09393

ELECTROMAGNETIC AERIAL SURVEY OF A FRESH WATER-SALT WATER CONTACT IN THE RHONE DELTA (FRENCH),
Bureau of Geologic and Mine Research (France); and Geoterrex Co. (France).
For primary bibliographic entry see Field 07B.
W70-09394

GEOPHYSICAL PROSPECTING AND RESEARCH ON UNDERGROUND WATER (FRENCH),
For primary bibliographic entry see Field 07B.
W70-09395

GEOPHYSICS IN UNITED NATIONS PROJECTS,
United Nations, New York.
For primary bibliographic entry see Field 07B.
W70-09397

APPLIED GEOPHYSICS IN THE NATURAL ENVIRONMENT RESEARCH COUNCIL IN GREAT BRITAIN,
Institute of Geological Sciences, London (England).
For primary bibliographic entry see Field 07B.
W70-09398

THE USE OF SEISMIC REFRACTION AND GRAVITY METHODS IN HYDROGEOLOGICAL INVESTIGATIONS,
Geological Survey, Raleigh, N.C.; and North Carolina Univ., Raleigh.
For primary bibliographic entry see Field 07B.
W70-09399

BOREHOLE GEOPHYSICS AS APPLIED TO GROUNDWATER,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W70-09400

GEOPHYSICAL PROSPECTING FOR GROUNDWATER IN THE SOVIET UNION,
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 07B.
W70-09401

A REVIEW OF SOME PROBLEMS OF SEISMIC PROSPECTING FOR GROUNDWATER IN SURFICIAL DEPOSITS,
Saskatchewan Univ., Saskatoon.
For primary bibliographic entry see Field 07B.
W70-09402

INTEGRATION OF GEOPHYSICAL METHODS FOR GROUNDWATER EXPLORATION IN THE PRAIRIE PROVINCES, CANADA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 07B.
W70-09403

INTEGRATION OF GEOPHYSICS AND HYDROGEOLOGY IN THE SOLUTION OF REGIONAL GROUNDWATER PROBLEMS,
Water Planning for Israel Ltd., Tel-Aviv.
For primary bibliographic entry see Field 07B.
W70-09404

THE ROLE OF GEOPHYSICS IN THE DEVELOPMENT OF THE WORLD'S GROUNDWATER RESOURCES,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W70-09405

SEISMIC METHODS IN MINING AND GROUNDWATER EXPLORATION,
Geological Survey of Canada, Ottawa (Ontario).
For primary bibliographic entry see Field 07B.
W70-09406

APPLICATION OF RESISTIVITY METHODS IN MINERAL AND GROUNDWATER EXPLORATION PROGRAMS,
Colorado School of Mines, Golden.
For primary bibliographic entry see Field 07B.
W70-09407

THE USE OF GRAVIMETER MEASUREMENTS IN MINING AND GROUNDWATER EXPLORATION,
Geonautics, Inc., Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-09408

INTERPRETATION OF GEOELECTRICAL RESISTIVITY MEASUREMENTS FOR SOLVING HYDROGEOLOGICAL PROBLEMS,
Federal Earth Research Inst., Hanover (West Germany).
For primary bibliographic entry see Field 07B.
W70-09409

GROUNDWATER RECORDS OF SOUTH CAROLINA - 1966,
Geological Survey, Columbia, S.C.
G. W. Stock, Jr. and G. E. Siple.
South Carolina Division of Geology Miscellaneous Report No 5, 1969. 39 p, 8 fig, 2 tab, 9 ref.

Descriptors: *Hydrologic data, *Groundwater, *South Carolina, Water levels, Water quality, Aquifers, Observation wells, Water wells, Water level fluctuations, Water yield, Evapotranspiration, Data collections.
Identifiers: Groundwater data.

During 1966, water levels were monitored in 33 observation wells in the South Carolina Coastal Plain. Four record high and nine record low water levels were recorded during the period. In general, water levels in wells unaffected by pumping reached maximum stage during the winter or early spring months and declined during the summer as a result of high discharge because of evapotranspiration and decreased recharge. Although precipitation records showed greater than normal rainfall, some areas experienced below normal rainfall and a decline in water level in several observation wells during the latter part of the year, when normally these levels would have recovered to higher stages. Waters from the sand aquifers of Tertiary and Cretaceous age in the inner Coastal Plain are acidic, soft and have a low dissolved-solids content. As these waters move towards points of discharge in coastal areas they become alkaline and higher in bicarbonate and dissolved solids content and are characterized as a sodium bicarbonate type. Limestone waters were hard, slightly alkaline, and of a calcium bicarbonate type. Progressive saltwater encroachment was not detected in any of the principal aquifers. (Knapp-USGS)
W70-09411

2G. Water in Soils

METHODS OF COMPUTING MAXIMUM SOIL FREEZING DEPTH,
For primary bibliographic entry see Field 02C.
W70-09104

MERICAL MODELING OF UNSATURATED ROUNDWATER FLOW AND COMPARISON ' THE MODEL TO A FIELD EXPERIMENT,
nsas Univ., Lawrence, and Geological Survey, rden City, Kans.
r primary bibliographic entry see Field 02F.
70-09107

ST-IRRIGATION MOVEMENT OF SOIL ATER: 1. REDISTRIBUTION,
sconsin Univ., Madison.
R. Gardner, D. Hillel, and Y. Benyamini.
ater Resources Research, Vol 6, No 3, p 851-1, June 1970. 11 p, 7 fig, 19 ref. ARS Grant FG-163.

escriptors: *Soil water movement, *Irrigation ter, Percolation, Unsaturated flow, Hysteresis, uations, Laboratory tests, Wetting, Nuclear oisture meters, Permeameters, Instrumentation. entifiers: Soil water redistribution.

ater content measurements by gamma-ray at-nuation in soil columns were made during redis-bution following irrigation. Approximate solu-ns of the unsaturated flow equation are derived at describe the water content above the initial tting front as a function of time. For times suffi-ently large, these solutions reduce to a frequently ed empirical expression, using constants related the capillary conductivity and soil water dif-sivity. (Knapp-USGS)
70-09124

ACTORS AFFECTING SEED GERMINATION NDER SOIL MOISTURE STRESS,
ational and Univ. Inst. of Agriculture, Rehovoth srael). Volcani Inst. of Agriculture Research.
r primary bibliographic entry see Field 02I.
70-09135

IGRATION OF SOLUBLE SALTS IN AN IR-IGATED FIELD IN RELATION TO RAINFALL ND IRRIGATION,
epartment of Agriculture, Lethbridge (Alberta). ater Resources Div.
r primary bibliographic entry see Field 03C.
70-09140

HE TERRESTRIAL ECOLOGY OF THE PADEFOOT TOAD SCAPHIOPUS HAMMON-II,
alifornia Univ., Riverside. Dept. of Life Sciences.
Ruibal, Lloyd Tevis, Jr., and Virgilio Roig.
SF Grant No. GB2447 and Philip L. Boyd Desert esearch Center Support. Copeia, No 3, p 571-84, Aug 29, 1969. 5 fig, 7 tab, 32 ref.

escriptors: *Toads, *Physiological ecology, *Bur-ows, *Soil water movement, *Water balance, nimal physiology, Distribution patterns, On-site vestigations, Ecology, Semiarid climates, smotic pressure, Moisture tension, Soil physical roperties, Soil moisture, Soil temperature, recipitation.
dentifiers: *Anurans, Fossorial animals.

padefoot toads live in burrows in Southeastern rizona from September to the beginning of the ainy season in July. The burrows are not located andomly. Regardless of methods used, it was vir-ually impossible to locate them without first seeing he toads emerge. They first emerged in several esert grassland sites in early July following an ex-remely light rain without runoff. Twenty-two of hese animals were sacrificed, and only 2 had tomach contents. Of 16 animals captured after the irst heavy rainfall, 12 had stomach contents. It ap-ears that at least some individuals move to the sur-ace before the rains begin and are able to detect nvironmental cues, however slight. Although everal species were seen, only the burrows of S. ammondii were found, always in sand soil. Average burrow depths ranged from 24-42 cen-imeters, increasing from September to June. Soil moisture measurements and laboratory data indicated the toads can absorb soil moisture through their skin when soil moisture tension is as high as 10 atmospheres. As soil moisture tension increases through the winter, their osmotic pressures increases by metabolic urea production. Apparently skin water permeability is, paradoxically, the crucial adaptation to desert survival for these toads. (Casey-Arizona)
W70-09146

A KINETIC AND EQUILIBRIUM STUDY OF THE ADSORPTION OF THE ORGANIC INSECTICIDES CARBARYL AND PARATHION UPON SOME SOIL ORGANIC MATTER SURFACES,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05A.
W70-09184

ON THE ADHESION OF PORE WATER IN FINNISH ARGILLACEOUS SEDIMENTS OF DIFFERENT AGE,
Helsinki Hydrological Office (Finland).
Jouko Soveri.
Nordic Hydrology, Vol 1, No 2, p 111-119, 1970. 9 p, 7 fig, 2 ref.

Descriptors: *Soil water, *Soil moisture, *Compaction, *Clays, Soil compaction, Capillary water, Pore pressure, Porosity, Hysteresis, Soil water movement, Retention, Consolidation, Soil mechanics, Soil engineering.
Identifiers: *Finland.

The conduct of pellicular water is influenced by adhesion forces in fine grain soils of different age and at different degrees of consolidation. Determinations were made by compression apparatus, by which it was possible to indicate the extrusion of pore water and the change of void ratio as well as the degree of consolidation of the natural state. During experiments the samples were subjected to loads of 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, and 16.0 kg/sq cm. For proper performance of the process each load was left on for 24 hours. The measurement of one sample together with the decompression-recompression experiment required 12 days and nights. The adhesion of pellicular water in older samples of similar consolidation is stronger, and older samples retain comparatively more water. (Knapp-USGS)
W70-09195

FINITE ELEMENT METHOD OF ANALYZING STEADY SEEPAGE WITH A FREE SURFACE,
California Univ., Berkeley.
Shlomo P. Neuman, and Paul A. Witherspoon.
Water Resources Research, Vol 6, No 3, p 889-897, June 1970. 9 p, 8 fig, 25 ref.

Descriptors: *Seepage, *Groundwater movement, *Free surfaces, *Dams, *Mathematical models, Digital computers, Aquifers, Water table, Leakage, Percolation, Anisotropy, Porous media.
Identifiers: Finite element analysis.

A new iterative approach to steady seepage of groundwater with a free surface was developed using the finite element method. This approach eliminates a number of difficulties that were inherent in the iterative procedures previously used to solve this problem, and rapid convergence is now assured in all cases. The method is applicable to heterogeneous porous media with complex geometric boundaries and arbitrary degrees of anisotropy. It can handle problems where the free surface is discontinuous and where portions of the free surface are vertical or near vertical. In addition, infiltration or evapotranspiration at the free surface can be handled with ease. Several examples are included to demonstrate the power of this new approach and to show how it can apply to a wider variety of free surface problems than has been possible before. (Knapp-USGS)
W70-09198

A MOVING BOUNDARY MODEL OF A ONE-DIMENSIONAL SATURATED-UNSATURATED, TRANSIENT POROUS FLOW SYSTEM,
Stanford Univ., Calif.
George M. Hornberger, and Irwin Remson.
Water Resources Research, Vol 6, No 3, p 898-905, June 1970. 8 p, 9 fig, 15 ref.NSF Grant GK 4525.

Descriptors: *Groundwater movement, *Soil water movement, *Saturated flow, *Unsaturated flow, *Mathematical models, Unsteady flow, Porous media, Digital computers, Water level fluctuations, Infiltration, Recharge.
Identifiers: Finite difference analysis.

A moving boundary model is proposed for one-dimensional transient flow of water through a porous medium of which part is saturated and part is unsaturated. The model is based upon a theory that implies a discontinous propagation of pore pressure at the saturated-unsaturated interface. The moving boundary model is used to study a gravity drainage problem. Two numerical procedures are developed to solve the problem, an approximate Taylor series method and a finite difference method. The validity of the methods was appraised by comparing the results with experimental data. The Taylor series method is limited in applicability because of a need for accurate determination of derivatives of hydraulic conductivity and of moisture content respecting pressure head. The finite difference solution is very efficient because only changes in the unsaturated region are computed and the need for iteration is obviated. (Knapp-USGS)
W70-09199

HYSTERESIS IN TWO SANDS AND THE INDEPENDENT DOMAIN MODEL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia).
T. Talsma.
Water Resources Research, Vol 6, No 3, p 964-970, June 1970. 7 p, 3 fig, 27 ref.

Descriptors: *Hysteresis, *Unsaturated flow, *Wetting, *Sands, Moisture content, Hydraulic conductivity, Potential flow, Hydraulics, Steady flow, Unsteady flow, Model studies, Hydraulic models, Capillary action.
Identifiers: Capillary hysteresis.

Hysteresis in the relations between moisture content, potential, and conductivity was measured on two sands, one fine grained and the other coarse and angular grained. Hydraulic conductivity was determined during steady flow at selected capillary potentials. Water uptake and release from the samples was measured volumetrically at equilibrium points using multistep increments of capillary potential. Sets of primary draining and wetting scanning curves were obtained for both sands. Anomalies existed in the total water release and uptake for both main branch and scanning curves of the coarse sand. Considerable hysteresis occurred in the moisture content-potential and conductivity-potential relationships but little, if any, hysteresis was observed in the moisture content-conductivity relationships. The independent domain theory of hysteresis predicted the scanning curves moderately well for the greater part of the hysteresis regions. Significant deviations were found in the high moisture content range in the fine grained sand. (Knapp-USGS)
W70-09209

EXPERIMENT IN THE LEACHING OF SALINE LAND IN SOUTHERN KAZAKHSTAN,
For primary bibliographic entry see Field 03C.
W70-09258

THE THREE-PHASE DOMAIN IN HYDROLOGY,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02F.
W70-09260

HYDROPHYSICAL PROPERTIES AND MOISTURE REGIME IN THE UNSATURATED ZONE,
A. A. Rode.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 33-48, 1968. 16 p, 5 fig, 1 tab, 21 ref.

Descriptors: *Soil water, *Unsaturated flow, *Soil water movement, Percolation, Infiltration, Recharge, Hydrogeology, Water storage, Moisture tension, Retention, Zone of aeration, Vadose water.
Identifiers: *Soil moisture regime.

The unsaturated zone consists of the strata extending from the surface down to the upper aquifer. These strata are porous. Pores are small and changeable in size and shape. Particles surrounding pores are characterized by high values of the specific surface and surface energy. The surface energy and gravity determine the behavior of moisture in the unsaturated zone. The tension (effective value of the surface energy) depends on the moisture content, reaching a maximum for dry soil and dropping to zero in saturated soil. As the change of tension proceeds, some sudden changes in properties of the soil-moisture appear. Certain values of moisture content known as hydrophysical constants correspond to these sudden changes. They quantitatively characterize the hydrophysical properties of the unsaturated zone. Most important hydrophysical constants are as follows: total water-holding capacity, minimum retentive capacity, moisture of capillary bonds rupture, wilting point, and maximum adsorptive capacity. Moisture within each interval between constants has characteristic properties and thus presents various forms of soil moisture. In the unsaturated zone layers with different forms of moisture may be distinguished. These are hydrological horizons and combinations of them form soil-hydrological profiles. Different types of moisture regime arise as controlled by climate, topography, vegetation and hydrophysical properties of the unsaturated zone. (See also W70-09262). (Knapp-USGS)
W70-09261

THE ROLE OF VEGETATION IN SOIL WATER PROBLEMS,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 02I.
W70-09262

COMPARATIVE STUDY OF THE WATER BALANCE IN THE AERATED ZONES WITH RADIO-ACTIVITE METHODS AND WEIGHABLE LYSIMETER,
Rijksfaculteit der Landbouwwetenschappen, Ghent (Belgium).
M. De Boodt, P. Moerman, and J. De Boever.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 63-74, 1968. 12 p, 4 fig, 5 tab, 4 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture, *Calibrations, *On-site tests, Boreholes, Lysimeters, Soil moisture meters, Instrumentation, Moisture meters, Nuclear meters.
Identifiers: *Weighable lysimeters.

In a gently undulating loam deposit measurements with a neutron moisture meter yield good results in freshly drilled auger holes but poor results in old auger holes when no special precautions are taken. Possible explanation for the deviation of the results is: (1) along the access tube the tight fitting of the soil has been lost due to rain infiltration causing a widening of the hole and hence the geometry of the measurement has been lost, (2) along the access tube preferential drainage may occur so the soil in the immediate vicinity of the access tube is dryer than in the more remote parts of the soil layer. Depending on the climatological conditions at the beginning of a drying period, the neutron moisture will yield mostly values which are too low and at the beginning of a wetting period the results obtained will be too high when old auger holes are used. To avoid eventual water movement along the soil surface and digging up of the whole profile of a 10 ton weighable lysimeter was constructed with an aluminium access tube in the center to take moisture samples. The comparison of the results obtained with the neutron moisture meter when a whole moisture profile is assessed with those obtained with the lysimeter confirms the hypothesis of the preferential pathway along the access tube. (See also W70-09264). (Knapp-USGS)
W70-09263

MEASURING SOIL MOISTURE IN THE BRENIG CATCHMENT: PROBLEMS OF USING NEUTRON SCATTER EQUIPMENT IN SOIL WITH PEATY LAYERS,
The Water Research Association, Medmenham (England).
J. A. Cole, and M. J. Green.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 74-88, 1968. 15 p, 7 fig, 2 tab, 13 ref.

Descriptors: *Soil moisture, *Nuclear moisture meters, *Calibrations, Moisture meters, Soil moisture meters, Clays, Soils, Permeability, Hydrogeology, Instrumentation.
Identifiers: Neutron-scatter moisture meters, Brenig watershed (Wales).

The Brenig Catchment in North Wales has podzolic and gley soils formed from a shaley parent material in conditions of 1300 mm annual average precipitation. The top horizon of these soils is a peat layer 10 to 40 cm in depth. As part of a water balance study over the 2020 ha catchment area, soil moisture profiles are being measured with the NIS 356 neutron scatter equipment at 15 sites. The paper describes the selection of an appropriate calibration curve for each horizon of the soil, relating neutron count to soil moisture, with due allowance for soil density, and content of iron or organic hydrogen. The correction of field observations for interface effects is discussed on the basis of laboratory measurement of interfaces with various moisture contrasts. The combination of random and systematic errors of measurement is fully discussed. After consideration of the total change in moisture contents at each locality in the Brenig Catchment, between one date and another, the variance of these changes during 1965 is found to be greater than would be explained by the individual errors of measurement. (See also W70-09265). (Knapp-USGS)
W70-09264

AN INSTRUMENT FOR MEASURING SOIL MOISTURE BY NEUTRON SCATTERING,
Swedish Meteorological and Hydrological Inst., Stockholm (Sweden).
For primary bibliographic entry see Field 07B.
W70-09265

CHANGES IN THE MOISTURE CONTENT OF THE TOPSOIL AS MEASURED WITH A NEUTRON MOISTURE GAUGE,
Institute of Technology, Stockholm (Sweden).
E. Danfors.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 96-104, 1968. 9 p, 6 fig, 3 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, *Calibrations, Moisture content, Nuclear meters.
Identifiers: *Neutron moisture gage (Surface).

In soils, the top layer may generally be regarded as the horizon which has the greatest hydrologic activity. As border zone between atmosphere and earth it is naturally involved in hydrological processes such as runoff, infiltration and evapotranspiration. Fluctuations in the moisture content of the topsoil reflect not only the characteristics of these activities, but also the capabilities of the soil as medium. A neutron surface gage (model P21 d/M Gauge, Nuclear Chicago Corporation) has been calibrated to register the moisture content in soils to a depth of 10 cm. Intermittent moisture measurements have been made with a few hours to a few days time spacing. The fluctuations observed have been related to several factors such as soil texture and structure, exposure and weather conditions. Adequate means of expressing moisture characteristics of the topsoil have also been considered with the purpose of attaining hydrologic significance. The neutron surface gage has been found to be an excellent tool in these investigations because of its speed of measurement, non-destructiveness and reliability. (See also W70-09267). (Knapp-USGS)
W70-09266

THE DETERMINATION OF SOIL MOISTURE WITH THE NEUTRON SCATTERING METHOD IN FINLAND,
Finnish Hydrological Office, Helsinki.
For primary bibliographic entry see Field 07B.
W70-09267

NEUTRON MOISTURE METER FOR SALINE SOILS,
All-Union Scientific and Research Institute of Hydrotechnics and Reclamation (USSR).
For primary bibliographic entry see Field 07B.
W70-09268

MEASUREMENT OF SOIL MOISTURE FROM THE TEMPERATURE GRADIENT,
Forest Research Inst., Budapest (Hungary).
For primary bibliographic entry see Field 07B.
W70-09269

SOME METHODS FOR THE DETERMINATION OF SOIL MOISTURE AND BALANCE MEASURING,
Hydraulic Research Inst., Prague (Czechoslovakia).
For primary bibliographic entry see Field 07B.
W70-09270

POLISH ISOTOPE APPARATUS FOR RESEARCH ON SOIL MOISTURE,
For primary bibliographic entry see Field 07B.
W70-09271

NUCLEAR TECHNIQUES IN HYDROLOGICAL INVESTIGATIONS IN THE UNSATURATED ZONE,
International Atomic Energy Agency, Vienna (Austria). Div. of Research and Laboratories.
For primary bibliographic entry see Field 07B.
W70-09272

CALIBRATION AND EVALUATION OF A WIDE RANGE METHOD FOR MEASURING MOISTURE STRESS IN FIELD SOIL SAMPLES,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 07B.
W70-09273

HYDRAULIC AND PRESSURE HEAD MEASUREMENT WITH STRAIN GAUGE PRESSURE TRANSDUCERS,
Illinois Univ., Urbana; and Agricultural Research Service, Urbana.
For primary bibliographic entry see Field 07B.
W70-09274

DIRECT MEASUREMENT OF MOISTURE POTENTIAL: A NEW TECHNIQUE,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 07B.
W70-09275

WATER TRANSPORT IN SOILS BY EVAPORATION AND INFILTRATION,
Rothamsted Experimental Station, Harpenden (England).
For primary bibliographic entry see Field 02D.
W70-09276

CAPILLARY CONDUCTIVITY DATA ESTIMATED BY A SIMPLE METHOD,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 07B.
W70-09277

DIFFUSIVITY DETERMINATION BY A NEW OUTFLOW METHOD,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 07B.
W70-09278

A STUDY ON PRESSURE MEMBRANE PROPERTIES IN RELATION TO CAPILLARY CONDUCTIVITY MEASUREMENTS,
Deutsche Akademie der Landwirtschaftswissenchaften zu Berlin (East Germany).
E. Vetterlein.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 203-213, 1968. 11 p, 9 fig, 4 tab, 4 ref.

Descriptors: *Capillary conductivity, *Membrane processes, *Osmosis, *Measurement, *Calibrations, Permeability, Soil water movement, Saturated flow, Unsaturated flow, Pore pressure, Soil temperature, Viscosity.
Identifiers: Water flow-osmotic pressure relations.

Experiments on permeability properties of pressure membranes lead to the following conclusions: The decrease of permeability of pressure membranes together with pressure increase on one side of the membranes was proved to be a combined effect of the pressure distribution in the water of membrane pores and turbulent flow of water. Measurements of permeability of pressure membranes carried out with the double membrane method--the membranes being in contact with the unsaturated soil--are similar to values of membrane permeability measured under conditions of saturated water flow. The temperature coefficients of membrane permeability and of capillary conductivity of soil are nearly equal. Apparently they are a function of the variations of water viscosity with temperature. Altogether the results of measurements state the possibility of a simple correction of membranes impedance on capillary conductivity measurements by means of the double membrane method. (See also W70-09280) (Knapp-USGS)
W70-09279

SOIL WATER DIFFUSIVITY AND WATER CONTENT DISTRIBUTION DURING OUTFLOW EXPERIMENT,
California Univ., Davis. Dept. of Water Science and Engineering; Oklahoma State Univ., Stillwater; Arizona Univ., Tucson; and North Dakota State Univ., Fargo.
J. M. Davidson, J. W. Biggar, D. R. Nielsen, A. W. Warrick, and D. R. Cassel.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 214-223, 1968. 10 p, 7 fig, 15 ref. Grant No DA-36-039-63-G5.

Descriptors: *Soil water movement, *Diffusivity, *Measurement, *Instrumentation, Calibrations, Moisture stress, Pore pressure, Membrane processes, Osmosis, Capillary conductivity, Tensiometers, Nuclear moisture meters, Soil moisture meters, Permeameters.
Identifiers: Soil diffusivity.

Difficulties with outflow or inflow systems for measuring soil water diffusivity stem from several causes. (1) The diffusivity changes so rapidly with moisture content that even for small changes created by small pressure steps, the assumption of a constant diffusivity is untenable. The measured water content redistribution within the sample during outflow is not compatible with that calculated for a constant diffusivity value. Hence, the volumetric outflow curves can only be matched approximately--giving rise to large discrepancies. (2) The attendant errors introduced by using a porous plate are difficult to overcome. Even if its impedance were estimated with sufficient accuracy, the additional contact impedance between plate and soil would remain undefined and dependent upon both soil water content and flux. (3) Different moisture content versus soil water pressure relations for different rates of establishing a given pressure yield inconsistent results regardless of plate or contact impedance corrections. Accurate gamma absorption techniques are available for soil water pressure monitoring especially in the tensiometer range. Calculations of diffusivity would not hinge on an assumption regarding the nature of the diffusivity and the rate of volumetric outflow. (See also W70-09281) (Knapp-USGS)
W70-09280

AN INFILTRATION METHOD FOR THE DETERMINATION OF THE CAPILLARY CONDUCTIVITY OF UNDISTURBED SOIL CORES,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 07B.
W70-09281

DETERMINATION OF CAPILLARY CONDUCTIVITY AND DIFFUSIVITY OF SOIL IN SITU,
R. Koitzsch.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 235-244, 1968. 10 p, 2 fig, 4 tab, 9 ref.

Descriptors: *Capillary conductivity, *On-site tests, *Instrumentation, *Tensiometers, Moisture stress, Moisture tension, Diffusivity, Membrane processes, Osmosis, Hydraulic conductivity.
Identifiers: In situ tensiometers.

An instrument for measuring capillary conductivity and diffusivity of soil in situ consists of a tensiometer with a cylindrical cup. The theory uses the analogy of heat conduction, in which a perfect conductor and the surrounding material are initially at different temperatures. It takes into account the influence of the hydraulic conductivity of the cup wall and the influence of an additional contact resistance which may sometimes exist. Suggestions are made for the design of the instrument and for reducing the nunber of observations. Simplification of interpretation is possible when the influence of the cup wall can be neglected and when an additional contact resistance does not occur. Experiments yielded capillary conductivity as well as diffusivity. (See also W70-09283) (Knapp-USGS)
W70-09282

DETERMINATION OF THE COEFFICIENTS OF WATER MIGRATION THROUGH SOILS,
Institute of Hydrotechnical Research, Bucharest (Rumania).
R. J. Bally.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 245-256, 1968. 12 p, 12 fig, 2 ref.

Descriptors: *Soil water movement, *Mathematical studies, Moisture tension, Moisture content, Capillary conductivity, Flow, Hydraulic gradient, Darcys law, Laboratory tests, Model studies, Pore pressure.
Identifiers: Soil water movements equations.

Differential equations for one-dimensional vertical and horizontal flow in the soil and the use of these equations for the determination of capillary conductivity and suction in relation to the soil moisture content are presented. Two conditions were used: (1) the continuity of water flux; (2) the equality between suction gradient in an elementary soil layer and the flow resistance in order to assure the increase in soil moisture content. The differential equations are functions of: variation in soil moisture content as a function of distance and time; capillary conductivity as a function of soil moisture content; suction as a function of soil moisture content. A verification of the proposed method is given with data from laboratory experiments. (See also W70-09284) (Knapp-USGS)
W70-09283

VALIDITY CONDITIONS OF THE POINT DILUTION METHOD,
Academia R. P. R., Bucharest.
For primary bibliographic entry see Field 02F.
W70-09284

DIVERGENCES BETWEEN EXPERIMENTAL AND THEORETICAL VALUES OF CAPILLARY DIFFUSIVITY (FRENCH),
State Coll. of Agronomical Sciences, Gembloux (Belgium).
L. Sine, and A. Bentz.
In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 263-277, 1968. 15 p, 13 fig, 1 tab, 17 ref.

Descriptors: *Soil water movement, *Diffusivity, *Measurement, Calibrations, Moisture stress, Drying, Infiltrometers, Moisture tension, Model studies, Laboratory tests, Discharge (Water), Nuclear moisture meters, Permeameters, Membrane processes, Osmosis.
Identifiers: Soil diffusivity.

The systematic measurement of diffusivity at low tensions, using the method proposed by Gardner, results in the following deviations between theory and experiment: the flow through the porous plate might be higher than the value calculated from theory; the obtained value of the diffusivity is a function of the height of the sample; the discharge at the lower boundary of the sample does not at all correspond with the moistre profile predicted by theory. The development of the moisture profile in samples 15 cm height was observed, using gamma rays for the measurement of the moisture content. A deviation between theory and experiment also appeared to exist during a study of the moisture profile above a water table. The development of the moisture profile depends on the initial and boundary conditions. (See also W70 09286) (Knapp-USGS)
W70-09285

VERIFICATION OF THE GENERALIZED DARCY'S LAW AND DETERMINATION OF CAPILLARY CONDUCTIVITY AT THE BEGINNING OF HORIZONAL INFILTRATION (FRENCH),
Laboratories of Fluid Mechanics, Grenoble (France).
Georges Vachaud.
In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The

Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 277-294, 1968. 18 p, 7 fig, 3 tab, 9 ref.

Descriptors: *Soil water movement, *Darcys law, *Capillary conductivity, Moisture content, Hydraulic gradient, Mathematical studies, Flow, Porous media, Unsaturated flow, Nuclear moisture meters, Laboratory tests.
Identifiers: Soil moisture profiles.

By analysis of both the moisture profiles, obtained by gamma ray absorption during infiltration in a soil column, and the wetting branch of the capillary pressure curve, a method is suggested for checking the validity of the generalized Darcy's law and obtaining capillary conductivity. At any time, for each value of the moisture content, the flow velocity is computed from the moisture profiles by integration of the continuity equation. The capillary gradients are obtained by substituting capillary profiles to moisture profiles. Plotting, for a given moisture content, the corresponding values of velocity versus gradient, we establish that a linear relationship exists, satisfying Darcy's law. The slope is the value of the capillary conductivity. (See also W70-09287) (Knapp-USGS)
W70-09286

HYDROLOGICAL CONSTANTS OF PAMPEAN SOILS: BROWN PRAIRIE AND BLACK PRAIRIE,
Buenos Aires Univ., (Argentina). Dept. of Agricultural Climatology and Fenology, and Agroclimatology Programme of the Centro de Investigaciones Agricolas Alberto Boerger, La Estanzuela (Uruguay).
Juan J. Burgos, and Walter C. Corsi.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 295-305, 1968. 11 p, 1 fig, 9 tab, 9 ref.

Descriptors: *Soil moisture, *Soil properties, *Prairie soils, Statistical methods, Bulk density, Field capacity, Wilting point, Sampling, Laboratory tests, Soil-water-plant relationships.
Identifiers: *Pampean soils.

Methods used to determine the hydrological constants of pampean soils are reviewed. Data measured in black and brown prairie soils are compared. The procedures for the determination of bulk density and field capacity in pampean soil gave more reliable results with the less disturbed soil samples. For this reason field tests are recommended in preference to the laboratory test made. Field capacity values for brown and black prairie or pampean soils over pampean loess are relatively high as compared to normal contents of prairie soils. Contents for these soils can be estimated at approximately 400 mm in a depth of one m. The wilting coefficient for brown prairie and black prairie soils over pampean loess is slightly higher for black prairie soils and may be estimated at between 240 and 250 mm for a depth of one m. The number of samples used in previous tests and a statistical analysis of the results disclose that in six soil samples the precision of the average bulk density was 0.02 to 0.03 g/cc; in thirteen tests to determine field capacity, precision was 10 to 13 mm per m of depth and in three samples to test wilting point, precision was 6 to 7 for a depth of one m in 95% of the cases. We consider that procedures requiring less handling of the samples and an increase in the drainage period could alter the results reported. (See also W70-09288) (Knapp-USGS)
W70-09287

THE RELATION BETWEEN LITHOLOGICAL PROPERTIES AND THE SHAPE OF THE DESCRIPTION CURVE,
Institute for Land and Water Management Research, Wageningen (Netherlands)
W. C. Visser.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 305-311, 1968. 7 p, 2 fig, 1 tab.

Descriptors: *Soil physical properties, *Soil moisture, Field capacity, Wilting point, Drying, Retention, Capillary water, Specific retention, Laboratory tests, On-site tests.
Identifiers: Desorption curves (Soil).

The desorption curve was studied as an important hydro-lithological soil property. Visual or field methods may be used to obtain clay content, humus content, and pore space data. The relation between the lithological properties and the shape of the desorption curve appears to be complex. The accuracy of graphical methods is not high, particularly in the range between field capacity and wilting point, where the practical importance is greatest. (See also W70-09289) (Knapp-USGS)
W70-09288

THE MICROHYDROLOGICAL CHARACTERIZATION OF SOILS,
Guelph Univ. (Ontario). Dept. of Soil Science.
D. E. Elrick.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 311-317, 1968. 7 p, 4 fig, 1 tab, 24 ref, append.

Descriptors: *Capillary conductivity, *Soil moisture, *Soil properties, *Classification, Moisture content, Moisture content, Moisture stress, Pore pressure, Laboratory tests, Hydraulic gradient, Soil water movement.
Identifiers: Microhydrological soil classification.

Within the limits of soil water diffusion theory, soils can be characterized with regard to their ability to transmit water by determining experimentally the relationships between soil water content and soil water pressure and between capillary conductivity and soil water content. A brief review of some methods and procedures that can be used to determine capillary conductivity and capillary diffusivity is presented. Data on the microhydrologic properties of a soil are presented and the effects of air-drying and sieving on these properties are discussed. (See also W70-09290) (Knapp-USGS)
W70-09289

EFFECTS OF SALTS AND ORGANIC MATERIALS ON THE HYDRAULIC CONDUCTIVITY OF THE SOILS,
National Taiwan Univ., Taipei. Dept. of Agricultural Chemistry.
Tsen-tuo Chen.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 317-323, 1968. 7 p, 2 fig, 3 tab, 3 ref.

Descriptors: *Hydraulic conductivity, *Soil chemistry, *Clays, *Organic matter, *Ions, Ion exchange, Colloids, Porosity, Percolation, Laterites, Peptides, Soil water movement.
Identifiers: *Latosols.

Effects of OH and Cl on the hydraulic conductivity of latosol clays treated with various amounts of Ca and Na were found greater than of the cations. It was concluded that OH peptized the sesquioxide bonds on collidal surfaces and subsequently caused the decrease in stability index and volume of pores with a diameter greater than 28.4 millimicrons and increased bulk density. All of these, consequently, reduced the hydraulic conductivity. The application of carbon and nitrogen sources, combined or separated, induced clogging or aggregation of the soil, depending on the relative rate of addition. These caused a tremendous change in hydraulic conductivities. For soils with low hydraulic conductivities, that the addition of organic materials with nitrogen increased hydraulic conductivity significantly at the end of five weeks percolation. For a soil with low hydraulic conductivity, the same treatment reduced hydraulic conductivity at the end of same period of percolation. Changes in pH, nitrogen and organic matter content and C/N before and after percolation were found insignificant. Importance of studying the changes in hydraulic conductivities caused by cultural practices or fertilization for plant growth is stressed. (See also W70-09291) (Knapp-USGS)
W70-09290

SOIL MOISTURE PRESSURE IN SOME CLIMATIC ZONES,
Institut Prikladnoi Geofiziki, Leningrad (USSR).
I. I. Sudnitsin.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 323-329, 1968. 7 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Soil moisture, *Climatology, *Pore pressure, Thermodynamics, Soil chemistry, Water chemistry, Soil water movement, Tensiometers, Freezing, Soil types, Moisture tension, Laboratory tests, Soil-water-plant relationships.
Identifiers: Soil moisture hygroscopy.

Soil moisture pressure (or potential) is characteristic of its thermodynamic state, mobility and availability for plants. Tensiometric, cryoscopic and hygroscopic methods were used to measure the soil moisture percentage versus pressure relationships for some soils in moist, semiarid and arid zones of the European part of the USSR. At high soil moisture percentage the pressure depends on the soluble salt content, and at low soil moisture percentage it depends on the exchangeable ion distribution and the specific surface of the soil particles. During the warm season the soil moisture pressure in the aeration zone decreases regularly in the direction of north to south as the climate becomes more arid. Pressure dynamics is a good criterion for estimating soil moisture conditions in the aeration zone and in plant water supply. Pressure dynamics depends not only on the climate, but also on soil properties and vegetation, especially the depth of the root zone. (See also W70-09292). (Knapp-USGS)
W70-09291

AN EMPIRICAL EXPRESSION FOR THE DESORPTION CURVE,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. C. Visser.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 329-335, 1968. 7 p, 4 fig, 1 ref.

Descriptors: *Soil moisture, *Drying, *Laboratory tests, Mathematical models, Moisture stress, Moisture content, Soil water movement, Statistical methods, Regression analysis.
Identifiers: *Desorption curves.

An empirical formula for the desorption curve was devised and tested on a large number of undisturbed soil samples. The two graphical methods to assess the four parameters are discussed and an example of the solution of these unknown parameters is given. A mathematical expression was evolved to make available a check on the accuracy of separate moisture stress-moisture content observations. The further purpose was to be able to transpose such relations as those between moisture stress and moisture flow into relations between moisture content and moisture flow. (See also W70-09293). (Knapp-USGS)
W70-09292

NFRARED SPECTROPHOTOMETRIC STUDY F WET CLAY SOILS (FRENCH),
stitute of Hydrotechnical Research, Bucharest Romania).
. Arcan.
: Water in the Unsaturated Zone, Vol I, roceedings of the Wageningen Symposium, The etherlands, June 19-25, 1966, International As- ociation of Scientific Hydrology, Publication No 2, p 336-334, 1968. 9 p, 11 fig, 1 tab, 7 ref.

escriptors: *Soil structure, *Soil chemical pro- erties, *Retention, *Moisture content, *Labora- ory tests, Spectrophotometry, Plasticity, Leaching, n exchange, Adsorption, Clays.
lentifiers: Infrared spectrophotometry.

Vith the aid of infrared spectra the soil structure nd the reciprocal action of soil particles and water r various clay soils in Romania was studied. The udies were performed with soils having a natural oisture content or dried at various temperatures. n order to get a correlation between the results ob- ained from the analysis and the physical conduct f the wet soil, the limits of plasticity, the velocity f disintegration of the soil in water and cation ad- orption were determined. The study shows that it possible to determine directly with spec- rophotometry the way in which the water is held y the soil particles, the degree of orientation and he thickness of the water film on the soil particles. See also W70-09294). (Knapp-USGS)
W70-09293

NFLUENCE OF SOIL STRUCTURE ON INFIL- TRATION AND pF VALUES OF CHERNOZEM AND CHERNOZEMLIKE DARK MEADOW SOILS,
Novi Sad Univ. (Yugoslavia). Faculty of Agricul- ure.
N. Vucic.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 344-350, 1968. 7 p, 11 tab, 14 ref.

Descriptors: *Soil moisture, *Moisture content, *Soil structure, *Chernozems, Laboratory tests, Irrigation, Leaching, Soil chemistry, Soil chemical properties, Porosity, Soil water movement, Infiltration, Retention, Drying, Sampling.
Identifiers: *Yugoslavia.

There is a definite correlation between the mechanical composition of a soil and the infiltration rate for non-structured or insufficiently structured soils. It is also known that soil structure changes the relation to a great extent and increases the infiltration rate. In soils with the same mechanical and structural composition, the infiltration rate is influenced by the stability of the aggregates, a quality of the soil which has not been often considered from this viewpoint. In the irrigation district of Vojvodina (Yugoslavia) 2 soil types dominate; chernozems and chernozem-like soils. They are very similar, have nearly the same mechanical and structural composition, and only very small differences in porosity, but have unequal stability of the aggregates, which causes large differences in infiltration rate. The differences are not only in the initial intake rate, but also in the time coefficient, in Kostjakov's formula. Noting the changes in aggregate composition of soils under infiltration, the value of pF data determined for disturbed soil, or for aggregates which do not represent the aggregates in situ, is questionable. The greatest moisture content determined at 1/3 atm. tension, and the lowest at 15 atm., were found in chernozem samples composed of aggregates of less than 0.25 mm. In samples with fractions from 10 to 0.25 mm, however, no differences in moisture contents were found. These facts are of great importance in connection with those soils with large aggregates that fall apart during cultivation or irrigation practice. (See also W70-09295). (Knapp-USGS)
W70-09294

ANALYSIS OF SOME FACTORS AFFECTING THE WATER VAPOUR DIFFUSION IN SOILS,
Khartoum Univ. (Sudan).
M. Kutilek.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 350-360, 1968. 11 p, 11 fig, 19 ref.

Descriptors: *Soil water movement, *Diffusivity, Soil structure, Soil texture, Soil chemistry, Mathematical studies, Unsaturated flow, Mathematical models, Moisture content, Moisture tension, Drying, Evaporation.
Identifiers: *Soil diffusivity, Polyphase flow.

The diffusivity of water vapor is considered to be a general characteristic of soil moisture transport. Values of Dw were computed for various models of soils. It is concluded that two cases, different in principle, have to be distinguished when analyzing the diffusion of water vapor in soils. In heavy soils where surface active clay particles are predominant, water vapor diffusion is inucnenced by the change of geometrical parameters (e.g. porosity) to a relatively low extent, and the mineralogical composition becomes the principal factor affecting diffusion. A high content of strongly hygroscopic materials (e.g. montmorillonite) brings about the decrease of the diffusivity by about 100. The influence of exchangeable cations is reverse when compared with the influence on the flow of liquid water. The bivalent exchangeable cations lower the diffusivity and the monovalent exchangeable cations raise the diffusivity, omitting the possible change of aggregation. In light soils where silt and sand particles are prdominant, since surface properties of these particles are uniform, the water vapor diffusion is affected primarily by the change of the geometrical parameters (porosity). The range of the changes is relatively small when compared with the changes caused by mineralogical composition of the heavy soils. (See also W70-09296). (Knapp-USGS)
W70-09295

MOISTURE CONTENT AND HYDROPHILITY AS RELATED TO THE WATER CAPILLARY RISE IN SOILS,
S. A. Wladitchensky.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 360-365, 1968. 6 p, 2 fig, 5 tab, 7 ref.

Descriptors: *Soil water movement, *Capillary conductivity, *Adsorption, *Capillary action, Unsaturated flow, Capillary fringe, Capillary water, Wetting, Pore pressure, Moisture content, Mathematical studies, Laboratory tests, Soil chemical properties.
Identifiers: Capillary rise (Soil water).

Because the limits of variation of soil properties are rather wide, an exhaustive description of capillary rise should be studied by expanding from studies of a single pore, to a system of pores, and at last to the soil as a whole. The uneven shape of the capillary rise curve is explained by differences in the dimension and shape of pores through which the water moves, and by differences in the character of pore walls. In particular the components of the soil have different hydrophility, and hydrophility of pore walls material is also influenced by adsorbed water and gas. The cosine of the wetting angle and the velocity of the capillary rise are a minimum at the hygroscopical moisture content. A series of experiments was carried out with water uptake by sand coated with humic acid. Humic acid reduces the hydrophility of sand particles and the velocities of water uptake. (See also W70-09297). (Knapp-USGS)
W70-09296

DETERMINATION OF PORE SIZE BY THE AIR BUBBLING PRESSURE METHOD,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 07B.
W70-09297

THE RELATION BETWEEN PARTICLE SIZE, PORE SIZE AND HYDRAULIC CONDUCTIVITY OF SAND SEPARATES,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. P. Stakman.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 373-384, 1968. 12 p, 6 fig, 2 tab, 14 ref.

Descriptors: *Porosity, *Porous media, *Sands, *Laboratory tests, *Instrumentation, Bubbles, Permeability, Permeameters, Tensiometers, Groundwater movement, Soil water movement, Unsaturated flow, Surface tension, Wetting, Capillary action, Pore pressure, Hydraulic gradient, Pressure.
Identifiers: *Pore size, Pore size determination, Air-bubble permeameters.

From the air bubbling pressure of sand separates the equivalent diameter of the largest bottle-neck in the capillary system can be calculated. The measured hydraulic conductivity of the sand separates is nearly directly proportional to the square of that diameter as well as to the square of the mean particle diameter. The measured results are compared with the hydraulic conductivity calculated with the Kozeny-Carman equation, based on laminar flow through a circular straight tube and with the Brinkman formula, based on the drag theory of permeability. (See also W70-09299). (Knapp-USGS)
W70-09298

REDISTRIBUTION OF MOISTURE AFTER INFILTRATION IN DRY SOILS. INFLUENCE OF GRAVITY,
Institut National de la Recherche Agronomique, Versailles (France). Soils Lab.
A. Feodoroff.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 385-389, 1968. 5 p, 2 figs, 1 tab, 6 ref.

Descriptors: *Wetting, *Soil water movement, *Percolation, Unsaturated flow, Infiltration, Drainage, Capillary action, Laboratory tests, Infiltrometers.
Identifiers: *Water redistribution.

The redistribution of water in soil after infiltration was studied by irrigating small (30 cm high and 3 cm diameter) soil columns by applying water at the tops. After infiltration, columns were sliced lengthwise immediately and after 24 hours. Others were inverted after 24 hours and examined after 24 more hours of standing inverted. The soils studied were a clay-loam, a silty clay loam, and a coarse sand. Gravity appears to have no great influence on water redistribution. It is concluded that the principal redistributive force is the attraction of dry soil in the wetting zone. (See also W70-09300). (Knapp-USGS)
W70-09299

INFILTRATION RATE AS RELATED TO HYDRAULIC CONDUCTIVITY, MOISTURE DEFICIT AND OTHER SOIL PROPERTIES,
Central Inst. for Agricultural Research, Bucharest (Romania). Soil Physics Lab.
A. Canarache, E. Motoc, and R. Dumitriu.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 392-401, 1968. 10 p, 5 fig, 3 tab, 29 ref.

Descriptors: *Infiltration, *Hydraulic conductivity, *Moisture deficit, *Soil properties, Unsaturated flow, Soil texture, Soil types, Soil profiles, Infiltrometers, Lysimeters, On-site tests, Laboratory tests, Sampling, Bulk density, Pore pressure.
Identifiers: Antecedent moisture content.

Correlation and regression analyses using data for some 150 soil profiles of different genetical and textural types were performed. Soil properties involved in the calculations were infiltration rate, clay content, porosity, hydraulic conductivity and moisture status. Water infiltration into the soil takes place through the non capillary pore space being directly proportional to its volume; positive correlations exist between infiltration rate and percent of water-free pores at field capacity (r = +0.364 and +0.541), as well as betwwen infiltration rate and log hydraulic conductivity (r = +0.520 and +0.509). At the same time, water penetrating into the soil encounters a resistance provided by the air compressed within pores ranging in size from those filled at field capacity to those filled at moisture content at the beginning of the determination. As such, infiltration rate is inversely proportional to the volume of these pores and negative correlations exist between infiltration rate and the moisture deficit (r = -0.240 and -0.216). No correlations were observed between infiltration rate and moisture content at the beginning of the determination or between infiltration rate and the total percent of water-free pores at that time. The multiple correlation coefficients involving infiltration rate, non capillary porosity and moisture deficit (R = 0.446 and 0.638) or infiltration rate, log hydraulic conductivity and moisture deficit (R = 0.610 and 0.548) were higher. (See also W70-09301). (Knapp-USGS)
W70-09300

INFILTRATION IN TERMS OF SOIL MOISTURE, RAIN INTENSITY AND DEPTH OF RAINFALL,
Hungarian Univ. of Agricultural Sciences, Godollo (Hungary).
K. Sagi.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 390-392, 1968. 3 p, 2 tab.

Descriptors: *Infiltration, *Soil water movement, *Rainfall, Penetration, Rainfall intensity, Rainfall-runoff relationships, Percolation, Retention, Soil moisture, Soil properties, Unsaturated flow.
Identifiers: Rainfall depth-infiltration relationships.

Infiltration into the soil from summer rains was determined on levelled plots of meadow clay soil, 154 by 21.5 m in area, under agricultural cultivation. A close relationship was demonstrated between rain intensity, amount of rainfall, and initial soil moisture on the one hand and infiltration on the other. On the basis of the relationship determined, probable values of infiltration are compiled in tables. (See also W70-09302). (Knapp-USGS)
W70-09301

THE NATURE OF THE MINIMAL WATER RETENTIVE CAPACITY,
Vsesoyuznaya Akademiya Selskokhozyaistvennykh Nauk, Moscow (USSR).
A. A. Rode.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 407-415, 1968. 9 p, 1 fig, 3 tab, 32 ref.

Descriptors: *Retention, *Field capacity, *Capillary water, Soil water, Water storage, Capillary action, Diffusion, Soil water movement, Soil temperature, Hydraulic gradient, Moisture tension.
Identifiers: *Soil water retention.

A soil uniform in texture is able to retain some water in equilibrium against gravity, providing that neither temperature nor tension gradients are effective. Such soil water is referred to as suspended moisture. The intrinsic minimal retentive capacity corresponds to maximal content of suspended moisture. The tension gradient does not operate after the solum has wetted through, and all gravitational water has moved out. If at some depth there is a dry layer with a moisture content less than minimal retentive capacity, the tension gradient arises, directed upwards from that layer. As influenced by this gradient, the suspended moisture starts moving very slowly towards the layer mentioned. This moisture is in a quasi-equilibrium state. The temperature gradient being effective and the moisture content being equal to the minimal retentive capacity, water movement as vapor opposing this gradient takes place. Losses of moisture as vapor are balanced by liquid water movement in the opposite direction. The moisture content tends to remain equal to minimal retentive capacity. The tension which corresponds to minimal retentive capacity varies considerably in soils of different texture, structures and consistence and can never become the same in soils of different characteristics. When expressed in cm of water, it equals numerically the maximal height of capillary rise. (See also W70-09303). (Knapp-USGS)
W70-09302

THE MOVEMENT OF WATER IN SANDY SOILS AFTER PLOUGHING AT A DEPTH OF 50 CENTIMETERS,
Bayerische Landesanstalt fur Bodenkultur, Pflanzenbau und Pflanzenschutz, Munich (West Germany).
Rid Heinrich.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 401-406, 1968. 6 p, 9 fig, 3 tab, 5 ref.

Descriptors: *Infiltration, *Soil structure, *Soil management, Permeability, Organic matter, Soil treatment, Deep tillage, Penetration, Percolation, Pervious soils, Sands, Clays, Seepage.
Identifiers: Soil infiltration capacity improvement.

An attempt was made to improve the water capacity of two sandy soils with different clay proportions by plowing in organic matter to a depth of 50 cm. This succeeded on the sandy soil while on the slightly clayey sand, during the course of the experiments, the same water contents were always measured on deep plowed as on normally plowed plots. The texture of the soil therefore may indicate the success of deep plowing. The importance of humus and the manner of working in the humus on sandy soils is emphasized. A tendency of enrichment of the nutrients in plowed under humus layers is indicated. (See also W70-09304). (Knapp-USGS)
W70-09303

A STUDY OF REDISTRIBUTION AFTER THE FINISH OF HORIZONTAL INFILTRATION (FRENCH),
Georges Vachuad.
In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 415-428, 1968. 14 p, 8 fig, 1 tab, 9 ref.

Descriptors: *Soil water movement, *Percolation, *Drainage, Unsaturated flow, Infiltration, Permeability, Hysteresis, Nuclear moisture meters, Capillary action, Capillary water.
Identifiers: *Soil moisture redistribution.

The evolution of the moisture profiles, after the end of an infiltration in an horizontal soil column, was followed by gamma-ray absorption. During the redistribution, it appears that there exist three different zones in the column, depending on the distance to the origin. In the first zone, near the surface, the flow is a uniform drainage; in the second one, a wetting process followed by a drainage; i the third one, the flow is a uniform wetting, at lea for the limits of time and length choosen. Usin both drainage and wetting branches of the capillar pressure curves, and analyzing the limit betwee the wetting and drainage flows in the column, method is suggested for computing the capillar pressure inside the hysteresis loop for each point o the column and at any time during the redistribu tion. (See also W70-09305). (Knapp-USGS)
W70-09304

A THEORETICAL ANALYSIS AND NUMERI CAL SOLUTIONS OF UNSATURATED FLOW IN SOIL,
Gifu Univ. (Japan). Faculty of Agriculture.
H. Kobayashi.
French resume. In: Water in the Unsaturated Zone Vol I, Proceedings of the Wageningen Symposium The Netherlands, June 19-25, 1966, Internationa Association of Scientific Hydrology, Publicatio No 82, p 429-439, 1968. 11 p, 4 fig, 8 ref.

Descriptors: *Soil water movement, *Mathemati cal studies, Computers, Mathematical models Equations, Numerical analysis.
Identifiers: Differential equations.

Mathematical solutions are given for unsaturate flow in soil. The equations derived from analysis o groundwater movement are solved by numerica methods using digital computers. The problem o one-dimensional horizontal flow is solved by usin the general Boltzmann's transformation and a iterative method. (See also W70-09306). (Knapp USGS)
W70-09305

ANALYSIS OF INFILTRATION INTO STRATIFIED SOIL COLUMNS,
Agricultural Research Service, Urbana, Ill.; and Illinois Univ., Urbana. Agricultural Experiment Station.
F. D. Whisler, and A. Klute.
French resume. In: Water in the Unsaturated Zone Vol I, Proceedings of the Wageningen Symposium The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 451-470, 1968. 20 p, 24 fig, 12 ref. USDA Contract No 12-14-100-5742 (41).

Descriptors: *Infiltration, *Soil water movement, *Stratification, *Laboratory tests, *Mathematical models, Percolation, Equations, Unsaturated flow, Saturated flow, Hysteresis, Hydraulic gradient, Permeability, Hydraulic conductivity, Moisture content.
Identifiers: *Stratified soils.

A numerical solution of the flow equation for water in soil was obtained for a flow system consisting of a vertical column of stratified soil materials which had been drained from saturation to equilibrium with a water table. Water was assumed to be applied at the top of the column as either rainfall or ponded water. Infiltration into such a system involves hysteresis; the soil at each point wets along a different wetting scanning curve. The solution of the equation depicts the time and depth distributions of water content and pressure head during the resulting infiltration as well as infiltration rate and accumulated water content. The properties of the soil that influence the flow are the water capacity and hydraulic conductivity. Several hypothetical cases included coarse-textured soils overlying fine-textured soils, fine-textured lenses in coarse-textured soils, and coarse-textured lenses in fine-textured soils. Comparisons were made between these cases and also nonstratified cases on the basis of pressure head-time profiles, moisture content-time profiles, infiltration rate changes, and accumulated water content changes. The numerical solution predicts a hold-up effect on the wetting front as it goes from a fine-textured layer into a coarse-textured one. The rate of advance of the fronts is faster for ponded infiltration than for rainfall infiltration. (See also W70-03907). (Knapp-USGS)
W70-09306

A LINEARIZATION TECHNIQUE FOR THE STUDY OF INFILTRATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. R. Philip.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 471-478, 1968. 8 p, 2 fig, 20 ref.

Descriptors: *Infiltration, *Soil water movement, *Mathematical studies, *Digital computers, Linear programming, Equations, Hydraulic conductivity, Hydraulic gradient, Soil moisture, Moisture content.
Identifiers: Delta function, Linearization techniques.

A linearization technique is given for the solution of non-linear problems in infiltration and other problems of water movement in unsaturated soils. The method consists, essentially, in matching exactly linear and non-linear solutions at small times, and in matching the solutions in some integral sense at large times. The method is worked out for one-dimensional infiltration. It is shown to yield results agreeing closely with the 'exact' non-linear solution and to provide algebraic infiltration equations equally valid for small and large times. The parallel use of similarity (or better, delta function) solutions provides a good method of approximate analysis, since the linear and the delta function solutions represent extremes of soil characteristics and, by implication, of hydrological behavior. We may, therefore, obtain insight into the general character of the phenomenon and the extent to which it may vary, and we may obtain, at the same time, an indication of the accuracy of the results. For one-dimensional infiltration, the similarity (or delta function) solution agrees well with the linear solution. (See also W70-09308). (Knapp-USGS)
W70-09307

SOLUTIONS OF THE NON-LINEAR DIFFUSION EQUATION WITH A GRAVITY TERM IN HYDROLOGY,
Technion - Israel Inst. of Tech., Haifa; and California Univ., Berkeley.
S. Irmay.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 478-499, 1968. 22 p, 4 fig, 1 tab, 32 ref, 2 append.

Descriptors: *Soil water movement, *Diffusion, *Mathematical studies, *Equations, Digital computers, Saturated flow, Unsaturated flow, Steady flow, Unsteady flow, Evaporation, Infiltration, Water level fluctuations, Groundwater movement, Aquifers, Capillary action, Capillary water.
Identifiers: Soil water movement equations.

The partial differential equation of unsaturated flow of liquids in porous media, especially of water in stable soils, is discussed: steady and unsteady flows, with or without gravity, in one-, two-, and three dimensional cases, in cartesian and cylindrical coordinates. The initial and boundary conditions are described, and the hodograph sphere (circle) method of saturated flow is extended to unsaturated media. A number of steady flow solutions are studied analytically and graphically. In unsteady flows the equations are transformed into an ordinary differential equation by the Boltzmann transformation, by a linear wave-like transformation, by similarity transformations, by separation of variables, and by other methods. The method outlined can be used in solving similar diffusion equations in other fields. (See also W70-09309). (Knapp-USGS)
W70-09308

SOME NUMERICAL METHODS FOR SOLVING PROBLEMS OF NON-STEADY SEEPAGE IN NON-HOMOGENEOUS ANISOTROPIC SOILS,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation (USSR).
L. N. Burejev, and Z. M. Burejeva.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 500-503, 1968. 4 p.

Descriptors: *Soil water movement, *Unsteady flow, *Seepage, *Anisotropy, *Computer programs, Mathematical studies, Digital computers, Numerical analysis, Mathematical models, Flow, Porous media, Unsaturated flow, Laplaces equation.
Identifiers: *Unsteady seepage.

A proposed method of computation of non-steady seepage consists of successive series of cycles each of which includes two stages of computation: the determination of components of speeds on a boundary and the determination of the new position of a boundary. The method makes it possible to construct an algorithm which is independent of the specific problem. This algorithm is used as a basis of the program for the BESM computer. (See also W70-09310). (Knapp-USGS)
W70-09309

ABSORPTION AND INFILTRATION IN TWO- AND THREE-DIMENSIONAL SYSTEMS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
J. R. Philip.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 503-525, 1968. 23 p, 7 fig, 18 refs.

Descriptors: *Infiltration, *Absorption, *Soil water movement, *Mathematical studies, Wetting, Capillary action, Percolation, Moisture content, Unsaturated flow, Steady flow, Unsteady flow.
Identifiers: Soil moisture profiles.

The theory of the dynamics of one-dimensional infiltration is well developed, but many practical problems involve two- and three-dimensional systems. The two-dimensional problem of infiltration from a semi-circular furrow and the three-dimensional problem of infiltration from a hemispherical cavity are examined. Exact series solutions of non-linear absorption problems are found which are appropriate for small times. For the three-dimensional case a steady large-time solution exists, and is evaluated. The corresponding linear and delta function solutions are also found; they agree well with the exact solutions. These various results support the argument that previous attempts to apply the Boltzmann transformation to this group of problems have been erroneous. The corresponding infiltration problems are formulated and the linear solutions developed. It is shown that: (1) the wetting region for both two- and three-dimensions is finite no matter how great the time (unlike for one dimension); and (2) the final steady state infiltration rate depends not only on the hydraulic conductivity, but also on the capillary properties of the soil. The influence of gravity in distorting the pattern of wetting decreases as the radius of the cavity or furrow decreases; and it is very much less in three dimensions than in two. (See also W70-09260). (Knapp-USGS)
W70-09310

INFILTRATION PROPERTIES OF THE SOILS OF THE CENTRAL CHERNOZEM PROVINCES,
A. M. Grin, and G. V. Nazarov.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic, US Agricultural Research Service, p 76-106, 1967. 31 p, 4 fig, 13 tab, 14 ref.

Descriptors: *Soil physical properties, *Soil properties, *Chernozems, *Infiltration, *Soil water, Absorption, Water balance, Analytical techniques, Forests, Vegetation effects, Geology, Land use, Permeability.
Identifiers: *USSR, Chernozem Provinces.

Infiltration properties of virgin land, cultivated land, forest and forest belt of the Chernozem region of the USSR were experimentally investigated. Chernozem soils have the highest infiltration capacity of the region and light-gray forest soils have the lowest. The greatest beneficial effect on infiltration is exerted by the forest and vegetation cover of virgin land areas. Grazing by cattle greatly impairs the infiltration properties of the soils both on cultivated land and in the forest. Forest belts exert a considerable beneficial influence on the soil by increasing its infiltration capacity. (See also W70-09312) (Gabriel-USGS)
W70-09313

AN APPROXIMATE METHOD FOR DETERMINING THE HYDRAULIC CONDUCTIVITY FUNCTION OF UNSATURATED SOIL,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
R. W. Skaggs, E. J. Monke, and L. F. Huggins.
Available from NTIS as PB-193 673, $3.00 in paper copy, $0.65 in microfiche. OWRR Project A-010-IND (6).

Descriptors: *Hydraulic conductivity, *Soil physical properties, Water properties, *Unsaturated flow, Non-saturated flow, *Pressure head, *Infiltration, Soil moisture, Soil water movement, Water content.
Identifiers: Richard's equation, Soil moisture characteristic.

A method is proposed for determining the hydraulic conductivity function of unsaturated soil. The method is based on the assumption that the conductivity-pressure head relationship, K (h), can be effectively represented by an empirical three-parameter equation. Procedure are given for evaluating the equation parameters from measurements of the soil-water characteristic, the saturated conductivity, and the infiltration rate-time relationship for an initially dry soil. Repeated numerical solutions to the Richard's equation for the movement in unsaturated soil are used with a search procedure to determine the parameter values giving the minimum difference between measured and calculated infiltration rate-time relationships. Computer programs, written in FORTRAN, were developed to apply and evaluate the method. An evaluation of the proposed method using soil property data obtained from the literature showed that a good approximation of the conductivity data could be obtained for soils in which the conductivity function had the general form of the assumed relationship. For soils having other forms of K (h), the functions obtained still allowed accurate predictions of the infiltration rate-time relationship for a wide range of initial water contents.
W70-09342

THE EFFECT OF TEMPERATURE ON WATER FLOW IN SOILS,
Mississippi State Univ., State College. Water Resources Research Inst.
R. D. Jensen, M. Haridasan, and G. S. Rahi.
Available from NTIS as PB-193 676, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Water Resources Research Institute, June, 1970. 43 p, 2 tab, 9 fig, 40 ref. OWRR Project B-002-MISS (1).

Descriptors: *Hydraulic conductivity, Pressure head, *Soil water movement, *Diffusivity, Soil moisture, *Temperature, Soil temperature, Thermal conductivity, *Conductivity.
Identifiers: Flux equations.

The dependence of the hydraulic conductivity of soil, the pressure head of soil water, and the soil water diffusivity on temperature, was investigated to determine the possible influence of temperature on water flow in soils. The hydraulic conductivity was found to be a function primarily of the soil water content. The effect of temperature on conductivity as a function of pressure head resulted primarily from the influence of temperature on the water content. At 35C the conductivity was larger at saturation, the soil drained at a larger pressure head, and the conductivity decreased at a faster rate than at 15C. Near saturation, when the water contents at the two temperatures were nearly the same, the increase in conductivity associated with rise in temperature can be explained by the effects of temperature on the viscosity of water. The pressure head as a function of water content increased as the temperature increased. This increase can be accounted for by the temperature dependence of the surface tension of air-water interfaces. The amount of water held by the soil at any given pressure head decreased with a rise in temperature. The effect of temperature on the diffusivity as a function of water content and pressure head was not significant except near saturation. The temperature dependence of the viscosity of water is sufficient to account for these effects. Techniques to resaturate a soil column, which avoided the difficulties caused by hysteresis, were developed so that repeated measurements of all the desired parameters could be made on the same sample of soil. Flux equations with measurable parameters which seem to adequately describe the flow of water and heat under nonisothermal conditions were presented.
W70-09345

EVALUATION OF SOIL MOISTURE MEASUREMENTS IN OKLAHOMA AS SOIL CHARACTERISTICS FOR CLASSIFICATION,
Agricultural Research Service, Stillwater, Okla.; and Oklahoma State Univ., Stillwater. Dept. of Agronomy.
J. D. Nichols, and J. F. Stone.
Soil Science Society of America Proceedings, Vol 34, No 4, p 638-641, July-August 1970. 4 p, 2 fig, 1 tab, 11 ref.

Descriptors: *Soil moisture, *Soil moisture meters, *Nuclear moisture meters, *Soil classifications, Instrumentation, On-site tests, Soil analysis, Soil investigations, Soil science, Soil types, Drying, Evaporation, Oklahoma.
Identifiers: Neutron moisture meters.

Soil moisture measurments were evaluated as soil moisture characteristics specified in the new soil classification system. Soil moisture measurements were made with a neutron probe at about weekly intervals and were available for 3 to 6-year periods at four sites with a range in mean annual precipitation of 45 cm to 80 cm. The cumulative days were counted when the soil moisture was below minus 15 atm pressure in either or both of the 0 to 23-cm increment and the 23 to 38-cm increment. The count was also made for the control section of the 23 to 38-cm increment and the 38 to 53-cm increment. The data yielded close fitting linear regression lines for cumulative days dry in each year against the measured precipitation for that year. The regression lines for the two tested control sections were nearly alike. The neutron probe method seems to be a satisfactory method for determining days dry. Some adjustment of the data may be necessary in translating the data for use in the classification system. (Knapp-USGS)
W70-09377

INFLUENCE OF RAINFALL ENERGY ON SOIL LOSS AND INFILTRATION RATES: 2. effect of clod size distribution,
Agricultural Research Service, Ames, Iowa; and Iowa State University, Ames.
W. C. Moldenhauer.
Soil Science Society of America Proceedings, Vol 34, No 4, p 673-677, July-August 1970. 5 p, 7 tab, 15 ref

Descriptors: *Soil erosion, *Runoff, *Rainfall-runoff relationships, *Impact (Rainfall), Laboratory tests, Model studies, Simulated rainfall, Raindrops, Soil structure, Soil physical properties.
Identifiers: Soil clod failure, Clods.

Various cold size distributions were subjected to drop impact from a water drop applicator that delivered only 5-mm drops. Increasing the maximum clod size from 20 to 40 mm did not delay the time for runoff to begin on four silt loam to silty clay textured Iowa soil samples taken from continuous-corn plots. Removing the clods smaller than 2 mm from the smaller than 40-mm sample had little effect on the time to runoff on continuous-corn soils, but did increase the time to initial runoff on the silt loam soil from meadow. Removing the fraction smaller than 8 mm from the smaller than 40-mm sample significantly increased the rainfall energy required to initiate runoff in all instances tested. Removing the fraction smaller than 30-mm from the smaller than 40-mm sample nearly doubled the energy to initial runoff. However, clod beds of this 30- to 40-mm size range from continuous corn did not withstand 0.18 joules per sq cm of rainfall energy, which commonly occur in western Iowa during the critical erosion period. Clod beds of the 30- to 40-mm size range from continuous meadow, in contrast to clod beds from corn land, did withstand 0.18 joules per sq cm of rainfall energy. (Knapp-USGS)
W70-09378

SOIL TEMPERATURE AND WATER CONTENT CHANGES DURING DRYING AS INFLUENCED BY CRACKS: A LABORATORY EXPERIMENT,
Iowa State Univ., Ames.
H. M Selim, and Don Kirkham.
Soil Science Society of America Proceedings, Vol 34, No 4, p 565-569, July-August 1970. 5 p, 6 fig, 2 tab, 7 ref. OWRR Project A-026-IA.

Descriptors: *Evaporation, *Soil water, *Expansive soils, *Cracks, Drying, Unsaturated flow, Soil water movement, Winds, Soil temperature, Soil structure, Soil physical properties, Laboratory tests.
Identifiers: Soil shrinkage cracks.

A container consisting of three identical compartments each 30 cm long, 30 cm deep, and 10 cm wide, was used to study the influence of artificial soil shrinkage cracks on heat and water content redistribution in three soil materials subjected to wind or radiative drying at 1.18 and 2.54 cm of water per 24 hours. Crack widths of 0, 0.64, and 1.91 cm were tested. Moisture content and temperature distributions were measured with time up to 12 days. The cracks decreased water content as much as 5 to 10% by volume. Evaporation through crack walls caused lateral movement of water for a distance of 4 to 5 cm from the wall of a 0.64-cm crack after 12 days of radiative drying. These distances were greater up to 14 cm in sand. Under wind, distances of lateral movement of water were about 5 cm for all drying times. In all three soils with cracks, after 4 days of wind drying soil temperature was cooler (1 to 2C lower) than for the soils with no cracks. Under radiation all three soils were warmer (5 to 10C higher) than soils with no cracks, after 4 days. In general, shrinkage cracks increased evaporation from bare soil 12-16% with cracks 0.64 cm wide and about 30% with cracks 1.91 cm wide as compared to evaporation from soils with no cracks. (Knapp-USGS)
W70-09379

FREEZING AND THAWING EFFECTS ON DRAINAGE,
Agricultural Research Service, Burlington, Vt. Soil and Water Conservation Research Div.
G. R. Benoit, and J. Bornstein.
Soil Science Society of America Proceedings, Vol 34, No 4, p 551-557, July-August 1970. 7 p, 7 fig, 6 tab, 22 ref.

Descriptors: *Soil water movement, *Frost, *Frozen soils, *Freezing, *Thawing, Melting, Percolation, Infiltration, Drainage, Soil structure, Soil physical properties, Particle size, Clays, Soil texture, Laboratory tests.
Identifiers: Soil water-frost relationships.

Laboratory studies were conducted on insulated models containing coarse sand (1-2 mm), fine sand (0.5-1 mm) and soil (0-2 mm and 2-4.8 mm) to determine the effects of freezing and thawing on sloping land drainage. Relations between structure and texture, rates and extent of ice formation, and rates and magnitudes of drainage were determined. Decreasing temperatures and subsequent ice formation decreased the relative mobility of water, thereby increasing water retention and decreasing rates of water transmission. The magnitude of the short-term, freeze-thaw effects on soil water retention and transmission was influenced by soil aggregate size, aggregate stability, and soil water content during freezing. On a long-term basis, drainage that results in a consistently lower water content during freeze-thaw cycles may lead to a changed soil structure and thus a changed drainage requirement. (Knapp-USGS)
W70-09380

A GAMMA-PHOTONEUTRON METHOD FOR LABORATORY STUDIES OF SOIL WATER,
Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
J. C. Corey, R. H. Hawkins, and R. F. Overman.
Soil Science Society of America Proceedings, Vol 34, No 4, p 557-560, July-August 1970. 4 p, 3 fig, 1 tab, 13 ref. USAEC Contract AT (07-2)-1.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, Deuterium, Heavy water, Nuclear meters, Bulk density, Soil texture, Laboratory tests, Instrumentation.
Identifiers: Photoneutron meters.

Using the gamma-photoneutron method, the heavy water content of laboratory soil columns can be measured independently of bulk density of soil, soil texture, light water content, and type of clay mineral. The method requires a radioactive source that emits gamma photons in excess of 2.23 Mev and a neutron detector. The neutron detector measures photoneutrons produced when the deuterium nuclei in the gamma radiation field split into a photoneutron and a proton. The number of photoneutrons detected is linearly related to the heavy water content of the soil column. (Knapp-USGS)
W70-09382

MEASUREMENT OF WATER POTENTIAL AND OSMOTIC POTENTIALS IN SOIL WITH A COMBINED THERMOCOUPLE PSYCHROMETER AND SALINITY SENSOR,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
R. D. Ingvalson, J. D. Oster, S. L. Rawlins, and G. J. Hoffman.
Soil Science Society of America Proceedings, Vol 34, No 4, p 570-574, July-August 1970. 5 p, 5 fig, 2 tab, 9 ref.

Descriptors: *Soil moisture meters, *Water chemistry, *Osmotic pressure, Instrumentation, Soil-water-plant relationships, Moisture stress, Salinity, Wetting, Drying, Laboratory tests.
Identifiers: Soil water chemistry, Matric potential, Psychrometers.

A combined thermocouple psychrometer and salinity sensor, which is embedded in a single ceramic body, is described. This design makes possible the measurement of the water and osmotic potentials of soil water at the same location in the soil. Errors produced by spatial variations in soil solution concentration, shown to be large, were eliminated by the instrument's ability to make both measurements on a single sample of soil solution. The instrument was tested in a soil-plant-water system, and the data obtained are reported.

Desaturation of the ceramic at matric potentials more negative than -2 bars was shown to have a significant effect on conductance of the salinity sensor. Correction for this effect is discussed. Measurements showed that cotton plants extracted more water from the less saline zones in the soil. This had the effect of lowering the water potential to approximately the same value at two depths in the soil profile at the end of a drying cycle. (Knapp-USGS)
W70-09384

2H. Lakes

FACTORS AFFECTING THE MOVEMENT OF WATER AND ORGANISMS WITHIN A REGULATED MULTIPURPOSE LAKE,
Washington State Water Research Center, Pullman.
Gerald F. Kraft, and David T. Mason.
Available from NTIS as PB-193 680, $3.00 in paper copy, $0.65 in microfiche. Completion Report, July 29, 1970. 17 p, 4 fig.

Descriptors: Lakes, Lake shores, Multiple-purpose reservoirs, Limnology, Thermal properties, E. coli, Density currents, Washington.
Identifiers: Lake Whatcom.

Lake Whatcom, in northwest Washington, occupies a glaciated former stream valley. It is an elongate multipurpose lake, 12 miles long and averaging 3/4 mile in width, of considerable depth (150 feet average), and is moderately eutrophic. A 40-inch pipeline delivers glacial melt water from the Middle fork of the Nooksack River 20 miles away to the southeast extremity; the outflowing stream and domestic water-supply pipeline (city of Bellingham) are at the northwest end. Surface current patterns induced by wind have been identified within the lake and have been reproduced in a fiberglas 1:2400-scale model. It was found that thermal barriers reduce daily the intermixing of surface waters between the major depressions in the lake. Near-shore patterns of these thermal barriers were correlated with an observed 10-fold increase in bacterial concentration between the fifteenth and first meter off-shore. A study was made of the survival time of the bacteria Escherichia coli, Staphylococcus aureus, unidentified lake isolates, and the blue-green alga Haematococcus lacustris, under various light intensities and in variously treated aged lake water. It was tentatively concluded that the rate of bacterial activity increased in the presence of phytoplankton, under specific light-intensity conditions. An analysis of littoral vegetation distribution has resulted in the identification of three communities. (Kraft-Washington State)
W70-09090

WATER QUALITY IN RELATION TO PRODUCTIVITY OF LAKE ASHTABULA RESERVOIR IN SOUTHEASTERN NORTH DAKOTA,
North Dakota Water Resources Research Inst., Fargo.
For primary bibliographic entry see Field 5C.
W70-09093

MONTHLY MEAN SURFACE TEMPERATURES FOR LAKE ONTARIO AS DETERMINED BY AERIAL SURVEY,
Meteorological Service of Canada, Toronto (Ontario).
Michael S. Webb.
Water Resources Research, Vol 6, No 3, p 943-956, June 1970. 14 p, 18 fig, 2 tab, 18 ref.

Descriptors: *Lake Ontario, *Evaporation, *Water temperature, *Surveys, *Remote sensing, Infrared radiation, Humidity, Solar radiation, Mass transfer, Mapping, Great Lakes.
Identifiers: Water surface temperature.

For calculations of evaporation losses by mass transfer techniques, and for many other research and operational applications, it is necessary to know the mean patterns of surface water temperature. Preliminary patterns of monthly mean surface water temperatures are presented for Lake Ontario, based on 36 airborne radiation thermometer surveys over a three-year period. Temperature values at each of the 89 points in a grid have been plotted against calendar date, and an annual temperature curve has been produced for each point. Values for the middle of each month have been determined by interpolation, and used to produce a pattern for each month. (Knapp-USGS)
W70-09206

WATER BUDGET OF UPPER KLAMATH LAKE SOUTHWESTERN OREGON,
Geological Survey, Washington, D.C.
Larry L. Hubbard.
For sale by US Geological Survey, Washington, DC 20402 - Price $0.50. US Geological Survey Hydrologic Investigations Atlas HA-351, 1 sheet, 1970. Text, 1 fig, 1 map, 4 graph, 1 tab, 5 ref.

Descriptors: *Lakes, *Oregon, *Hydrologic budget, *Water balance, Streamflow, Springs, Precipitation (Atmospheric), Discharge (Water), Water storage, Water level fluctuations, Evapotranspiration.
Identifiers: Klamath Lake (Oreg).

A 1-sheet hydrological atlas presents a quantitative water budget for Upper Klamath Lake. It includes an inventory of water entering and leaving the lake and changes in lake storage for the 3-year period Oct. 1, 1964, to Sept. 30, 1967. Upper Klamath Lake, just east of the Cascade Range and about 17 miles north of the California State line, has a drainage area of 3,810 sq mi and is the largest lake in Oregon. It is about 22 mi long, with about 165 mi of shoreline and a mean depth of about 8 ft. Depths reach 40 to 50 ft in a narrow strip of the lake between Eagle Ridge and Bare Island. Mean annual precipitation is 14 inches at Klamath Falls at the south end of the lake and 18 inches at Chiloquin near the northeast end of the lake. Much of the precipitation in the lake area falls as snow from November through March. Average annual lake evaporation is about 40 inches. Surface inflow provided 79% of the total inflow to the lake. Precipitation falling directly on the lake provided 7% of the total inflow. Surface outflow constituted 84% of the outflow from the lake. Over the 3-year study period, evapotranspiration accounted for the remaining 16% of the total outflow. During the period of the study there was slight net decrease in lake storage. (Knapp-USGS)
W70-09250

WATER BALANCE AND SILTING OF SMALL RESERVOIRS IN THE CENTRAL CHERNOZEM OF THE RUSSIAN SOVIET FEDERAL SOCIALIST REPUBLIC.
For primary bibliographic entry see Field 02J.
W70-09312

ELEMENTS OF THE WATER BALANCE OF SMALL RESERVOIRS OF THE CENTRAL CHERNOZEM PROVINCES,
I. N. Sorokin.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic, US Agricultural Research Service, p 107-143, 1967. 37 p, 4 fig, 8 tab, 26 ref.

Descriptors: *Water balance, *Reservoirs, *Ponds, *Chernozems, Surface waters, Groundwater, Discharge (Water), Irrigation, Seepage, Evaporation, Runoff, Rivers, Mapping, Seasonal, Floods, Precipitation (Atmospheric), Gaging stations.
Identifiers: *USSR, Chernozem Provinces.

The water balance and hydrological regime of small reservoirs and ponds of the Chernozem Provinces of the USSR were experimentally investigated by collecting and analyzing inflows of surface water, annual runoffs, winter floods, precipitation, evaporation, and seepage data. A comparison of the mean surface runoffs in spring of small rivers and intermittent watercourses with previously made maps shows that in many cases these values are in close agreement. Winter floods occurred in seven of the ten winters of 1950 to 1959, In the northern part of the Chernozem province evaporation losses are about 20% of the normal volume of ponds. In the Karsk Province and the Voronezh Province they are 40 and 50%, respectively. Seepage changes are affected by the fluctuations of reservoir water levels. (See also W70-09312) (Gabriel-USGS)
W70-09314

THE BALANCE METHOD OF COMPUTING SEDIMENT FLOW AND ESTIMATING THE RATE OF SILTING OF RESERVOIRS,
For primary bibliographic entry see Field 02J.
W70-09315

2I. Water in Plants

AN ENERGY BUDGET STUDY ABOVE THE FOREST CANOPY AT MARMOT CREEK, ALBERTA, 1967,
Meteorological Service of Canada, Calgary (Alberta).
For primary bibliographic entry see Field 02D.
W70-09111

WATER USE BY SALT CEDAR,
Geological Survey, Lubbock, Tex.; and Texas Tech Univ., Lubbock.
For primary bibliographic entry see Field 02D.
W70-09113

FACTORS AFFECTING SEED GERMINATION UNDER SOIL MOISTURE STRESS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
A. Hadas.
Israel Journal of Agricultural Research, Vol 20, No 1, p 3-14, Jan 1970. 6 fig, 2 tab, 12 ref.

Descriptors: *Seeds, *Germination, *Moisture stress, *Soil moisture, *Diffusivity, Arid lands, Semiarid climates, Plant growth, Vegetation establishment, Soil-water-plant relationships, Environmental effects, Viability, Moisture availability, Clovers.
Identifiers: *Israel, *Chickpeas.

Factors intrinsic to the seed, to the soil, or to both seed and soil may inhibit germination of seeds under soil moisture stress. The relative importance of such factors was evaluated, including soil moisture potential, soil moisture diffusivity, water diffusivity of seeds, and characteristics of the seed-soil interface. Experimental results from chickpea (Cicer arietinum L. local variety) and clover (Trifolium alexandrinum L. var. Musgawi) suggested that germinating seed can be supplied with soil moisture at a rate equal to or greater than the capacity of the seed to absorb it. Both the amount of water actually absorbed by the seed and the subsequent germination rate depended on the adaptability of the internal moisture potential of the seed and on the real potential at the seed-soil interface. In this experiment it also appeared that the effective stress of the soil matrix had little, if any, influence on germination. (Carr-Arizona)
W70-09135

THE EFFECT OF SOIL MOISTURE LEVEL OF THE INCIDENCE OF EARLY BLIGHT ON POTATO AND TOMATO PLANTS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
J. Rotem.

Israel Journal of Agricultural Research, Vol 19, No 3, p 139-141, July 1969. 1 tab, 1 fig, 4 ref.

Descriptors: *Potatoes, *Tomatoes, *Blights, *Soil moisture, *Turgidity, Plant diseases, Infection, Disease resistance, Environmental effects, Arid climates, Arid lands, Irrigation effects, Irrigation, Irrigation programs, Moisture uptake, Soil water, Field crops, Crop production, Leaves, Soil-water-plant relationships.
Identifiers: *Early blight, *Israel, *Negev Desert, *Irrigated agriculture, Flowers.

Potted potato and tomato plants were inoculated with Alternaria porri f. sp. solani and studied to see what effect various soil moisture levels would have on the incidence of early blight. High levels of soil moisture before inoculation were found to be associated with increased susceptibility to the disease. Higher moisture levels were also directly related to increased yield/foliage weight ratio, which is a known predisposing factor for early blight. In half of the tomato plants the effect of different yield/foliage weight ratios resulting from various irrigation treatments was nullified by removing the flowers. For these plants, low soil moisture level was associated with the highest degree of infection (LSD = 5 percent). In the experiment with potatoes, increased leaf turgidity resulted in greater susceptibility to blight in all of the irrigation treatments. It would appear that the increased susceptibility of tomatoes and potatoes to early blight when grown at high soil moisture levels is due to the high yield/foliage weight ratio, which is in turn associated with a lowering of the resistance mechanism. (Carr-Arizona)
W70-09137

THE STABILITY OF WHEAT EMBRYO GLUTAMATE DECARBOXYLASE UNDER CONDITIONS OF WATER STRESS,
Texas Univ., Arlington. Dept. of Biology.
Claude Nations.
Canadian Journal of Botany, Vol 45, No 11, p 1917-1925, Nov 1967. 3 fig, 2 tab, 17 ref.

Descriptors: *Wheat, *Drought resistance, *Moisture stress, *Enzymes, *Plant physiology, Proteins, Lipids, Molecular structure, Drought tolerance, Germination, Embryonic growth stage, Semiarid climates.
Identifiers: *Glutamate decarboxylase, *Seedlings.

The stability of glutamate decarboxylase in wheat embryos and seedlings (Triticum aestivum L. variety concho) was studied in an attempt to obtain information suggesting a molecular basis for plant drought resistance. Decarboxylase activities in germinating wheat grains were measured before and after drying and an effort was made to relate enzyme activity to a soluble or particulate cell fraction by differential centrifugation. Active protein preparations were subjected to defatting treatments with n-butanol and then their responses to drying were measured. While decarboxylase activity in germinating wheat increased for 54 hr, enzyme stability decreased during this period. No activity could be detected in particulate cell fractions. The responses to desiccation by the extracted enzyme suggest that the stability of decarboxylase may lie in its ability to dissociate into smaller protein components when under moisture stress. It appears that this ability may depend upon the presence of lipids, which might be the source of a reversible association between enzyme components. (Carr-Arizona)
W70-09138

EFFECT OF SOIL PROFILE TYPE AND FERTILIZER ON MOISTURE USE BY WHEAT GROWN ON FALLOW OR STUBBLE LAND,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
For primary bibliographic entry see Field 03F.
W70-09139

EFFECT OF VARIATIONS IN SUBSTRATE SALINITY ON THE WATER BALANCE AND IONIC COMPOSITION OF BEAN LEAVES,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research; and Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
A. Meiri, and Alexandra Poljakoff-Mayber.
U.S. Department of Agriculture Grant No. FG-IS-179. Israel Journal of Botany, Vol 18, No 3, p 99-112, 1969. 5 fig, 1 tab, 34 ref.

Descriptors: *Halophytes, *Osmotic pressure, *Water balance, *Salt tolerance, *Water potential, Turgidity, Soil-water-plant relationships, Chlorides, Cations, Anions, Conductivity, Leaves, Sodium, Potassium, Calcium, Magnesium.
Identifiers: *Glycophytes, *Osmotic adjustment, *Relative water content, *Cell sap, Refractive index, Block design, Hoagland culture solution, Trifoliate leaves, Split-plot design.

Studies on glycophytes and halophytes in saline solutions have shown that osmotic adjustment takes place through ionic absorption and resulting increased water uptake. These experiments differed from actual field conditions in that the salinity levels were constant. Bean seedlings (Phaseolus vulgaris) were exposed to increasing NaCl concentrations, up to-2.8 atmospheres, over varying increments of time. The increasing salinities caused a reduction in water potential accompanied by a slower reduction in osmotic potential (OP) and consequent reductions in relative water content and tissue turgor (P). Sap concentrations, both metabolites and ions increased. The inorganic increas, especially chloride, was most prominent. This in turn caused increased P, which levelled off at final constant salinity. The sap OP decreased less rapidly than the external solution while tissue water potential decreased more rapidly than either. These effects were proportional to salinity rates of change. Adjustments to constant salinity resulted from gradual ion accumulation. The bean plant is therefore capable of adjusting its water balance depending on the rate of change of salinity and tissue age. (Casey-Arizona)
W70-09144

PHYSIOLOGICAL RESPONSES TO TEMPERATURE AND DESICCATION IN THE ENDEMIC NEW MEXICO PLETHODONTIDS, PLETHODON NEOMEXICANUS AND ANEIDES HARDII,
New Mexico State Univ., University Park. Dept. of Biology.
Walter G. Whitford.
NASA Grant NGR 32-003-27. Copeia, No 2, p 247-251, June 5 1968. 2 fig, 4 tab, 13 ref.

Descriptors: *Salamanders, *Physiological ecology, *Moisture stress, New Mexico, Ecology, Animal behavior, Distribution patterns, Amphibians, Circulation (Animals), Oxygen requirements, Respiration, Semiarid climates.
Identifiers: *Critical thermal maxima, *Oxygen consumption, *Tissue de siccation, *Heart rate, Relict species, Critical activity point, Temperature-metabolism curves.

The physiological parameters, oxygen consumption, desiccation limits, and critical thermal maxima (CTM) are valuable in interpreting ecological relationships and distributions of amphibia. Plethodon neomexicanus and Aneides hardii are 2 relict species of plethodontid Salamanders in the Jemez Mountains of New Mexico. The mean CTM of both species are almost identical and similar to that of a relative living in cold mountain streams of southern Appalachia. This probably reflects adaptations to their cold microhabitat. Thermetabolism-temperature curves differed and were probably related to differences in respiratory surface area since cutaneous gas exchanged accounts for 75-90 percent of total oxygen consumption in plethontids. Differences in desiccation rates may be due to differences in behavior while in the dessication chamber. P. neomexicanus is similar to other western species in having a higher tolerance to desiccation than eastern plethodons. This together with the requirement of fairly low, ambient temperatures to obtain sufficient metabolic oxygen indicates a dispersal from the east, across Oklahoma to New Mexico, possibly during the Pleistocene. (Casey-Arizona)
W70-09145

MINERAL METABOLISM OF HALOPHYTES,
California Univ., Davis. Dept. of Soils and Plant Nutrition.
Emanuel Epstein.
Supported by grants from the Office of Saline Water, U.S. Department of the Interior. In: Ecological Aspects of the Mineral Nutrition of Plants, Blackwell Scientific Publications, London, p 345-356, 1969. 3 fig, 22 ref.

Descriptors: *Halophytes, *Salt tolerance, *Osmotic pressure, *Water balance, *Carriers, Sodium, Chlorides, Potassium, Arid lands, Turgidity, Water stress, Soil-water-plant relationships, Calcium.
Identifiers: *Mineral metabolism, *Glycophytes, *Osmotic adjustment.

Halophytes are a varied flora of oceans, other salty waters and arid and semi-arid lands. Within the general limits of all plants they (1) Are salt-tolerant (2) Selectively acquire essential elements and water, often against high concentration gradients (3) Block excessive ion uptake which would interfere with cellular metabolic mechanisms or tissue osmotic potentials. Carriers in the cell membrane operate to selectively absorb certain ions. For a given ion, 2 types of carrier probably exist. One operates at low external concentrations up to 0.5 mM, excluding other ions. It occurs in both halophytes and salt-sensitive plants. The second type operates at high external concentrations, in some cases greater than 50 mM. Both leaf and long-term experiments with Atriplex and Agropyron species verify the second type crucial in halophytes. Selective ionic absorption causes an equilibration of external and tissue osmotic pressures resulting in a plant water potential that maintains adequate tissue turgor. Salt glands and succulence are 2 other salt-tolerance mechanisms occurring in some halophytes. (Casey-Arizona)
W70-09147

HEART RATE AND CHANGES IN BODY FLUIDS IN AESTIVATING TOADS FROM XERIC HABITATS,
New Mexico State Univ., University Park. Dept. of Biology.
Walter G. Whitford.
National Aeronautics and Space Association Grant NGR-32-003-27. In: Physiological Systems in Semiarid Environments, University of New Mexico Press, p 125-133, 1969. 5 fig, 7 ref.

Descriptors: *Toads, *Aestivation, *New Mexico, *Xerophilic animals, *Physiological ecology, Physiology (Animal), Environmental effects, Metabolism, Mode of action, Moisture stress, Oxygen requirements, Respiration, Water balance, Ureas, Chlorides, On-site investigations, Arid lands, Laboratory investigations.
Identifiers: *Body fluids, *Fossorial animals, Bradycardia.

Three species of fossorial New Mexican toads, Scaphiopus hammondi Bufo punctatus and Bufo cognatus, survive desiccating desert conditions by aestivating in their burrows for 10 months a year. The gross metabolic factors of heart rate and body fluids were measured in both aestivating and non-aestivating specimens. Heart rates as measured by electrocardiograms decreased 4-6 fold with number of days burrowed. Recently surfaced animals had control level heart rates. This bradycardia associated with aestivation is probably a reflection of reduced metabolism. Importantly, reductions in both heart rate and metabolism were temperature-independent. Body fluid chlorides showed a small increase, hemoglobin a small

crease, and urea doubled. The urea increase was pected because it is a major fossorial anuran ter conservation mechanism in xeric habitats. asey-Arizona)
70-09148

ATER ECONOMY OF THE GREEN-TAILED OWHEE (CHLORURA CHLORURA),
izona Univ., Tucson. Dept. of Biological iences.
Linwood Smith, and Robert D. Ohmart.
Physiological Systems in Semiarid Environnts, University of New Mexico Press, p 115-124, 69. 4 fig, 10 ref.

escriptors: *Birds, *Moisture stress, *Physiologil ecology, Arid lands, Arizona, Water balance, imal behavior, Animal physiology.
entifiers: *Green-tailed Towhees, Water econo-y.

vo crucial water economy adaptations in desert imals are the relative abilities to tolerate hydration and to utilize saline drinking water. ie Green-tailed Towhee winters in southern rizona but is not a resident or desert bird. It was own it needs 3-5 milliliters of water per day to aintain its body weight and could discriminate tween distilled and salt water. Expressed as ecentage of body weight, the distilled water ank by 10 adults (68.2) was significantly greater an 0.1M Na Cl solution (58.5). Similarly daily ody weight fluctuations were only significant with l and 0.2 M NaCl. Of 20 birds tested on 0.25 M aCl solution, half died in 6 days and 7 survived 18 ys with little weight loss. Of these, 4 survived on 3M NaCl and 1 on 0.35 M NaCl. No enlarged sal salt glands were found on those dying from 3-0.35M NaCl. The appearance of 2 intraspecific oups with respect to 0.25M NaCl solution utilizaon could not be explained with present data. Posbilities are: (1) Individual variation (2) Evolution a physiological subspecies (3) Derivation from a rically-adapted parental stock. The water econoy efficiency of small desert birds has been shown be greater than that of the Green-tailed Towhee. Casey-Arizona)
70-09149

HE ROLE OF VEGETATION IN SOIL WATER ROBLEMS,
othamsted Experimental Station, Harpenden England).
L. Penman.
rench resume. In: Water in the Unsaturated Zone, ol I, Proceedings of the Wageningen Symposium, he Netherlands, June 19-25, 1966, International ssociation of Scientific Hydrology, Publication lo 82, p 49-61, 1968. 13 p, 2 fig, 1 tab, 26 ref.

escriptors: *Soil-water-plant relationships, Evapotranspiration, *Evaporation, Vegetation efects, Water balance, Soil water movement, Moisture tension, Humidity, Root distribution, Root zone, Soil moisture, Permeability, Weather.
dentifiers: *Potential evaporation, Potential vapotranspiration.

he main mechanism for producing unsaturation is vaporation from growing plants. In some clay soils he drying produces cracks whose persistence may letermine soil permeability at saturation. Movenent of water, and limiting values of soil water conents, are determined by soil moisture potentials, nd energy supply is rarely a controlling factor. The ower limit of water content depends on the depth f root penetration, and the degree of ramisfication within the root depth: plant and soil characters letermine these quantities. Adding the concept of accessibility to that of availability reconciles some clashes in field evidence about how long actual evaporation remains equal to potential evaporation. Examples of plant/soil interactions considered include a range of soil depths, contrasts in plant type and different climates. (See also W70-09263). (Knapp-USGS)
W70-09262

A STUDY OF THE AQUATIC ECOSYSTEMS IN TWO NATIONAL WATERFOWL REFUGES IN MISSISSIPPI,
Mississippi State Univ., State College. Water Resources Research Inst.
Dale H. Arner, Earl D. Norwood, and Billy M. Teels.
Available from NTIS as PB-193 677, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Water Resources Research Institute, June 1970. 32 p. OWRR Project A-036-MISS.

Descriptors: *Aquatic environment, *Aquatic animals, *Wood duck, *Ecosystems, *Invertebrates, *Waterfowl, Phytoplankton, Mississippi, Soils, Dissolved solids, Water chemistry, Soil chemistry.
Identifiers: Noxubee national waterfowl refuge, Yazpp national waterfowl refuge.

A study was made of the aquatic ecosystems of the Yazoo and Noxubee national waterfowl refuges in Mississippi. This study revealed the following: (1) Soils of the Yazoo refuge were higher in potash and less acid than the Noxubee soils. (2) Water analysis revealed that the water of the Yazoo refuge had greater concentration of several important dissolved solids and more carbon dioxide than the Noxubee refuge. (3) Phytoplankton concentrations were greater in the Yazoo refuge. (4) During the late winter and early spring season a larger biomass of invertebrates was found in the aquatic plant communities of the Yazoo refuge. (5) The mean clutch size of wood ducks using artificial nesting boxes in the Yazoo refuge was higher than in the Noxubee refuge.
W70-09346

PADDY RATOONS,
Institute of Agricultural Research, Addis Ababa (Ethiopia).
For primary bibliographic entry see Field 03F.
W70-09501

2J. Erosion and Sedimentation

TRACER STUDIES ON THE MOVEMENT OF SAND AND GRAVEL,
Kyoto Univ. (Japan).
Katsumasa Yano, Yoshito Tsuchiya, and Masanori Michiue.
13th Congr Int Assn. Hydraul Res, Proc Vol 2, p 121-129, Aug-Sept 1969. 9 p, 6 fig, 11 ref.

Descriptors: *Sediment transport, Sediment discharge, Sedimentation, Bed load, *Tracers, Sands, Gravels, *Mathematical models, *Laboratory tests, Stochastic processes, Equations, Foreign research, Color.
Identifiers: *Stochastic models, *Bedload movement, Particle velocity, Formulas, Empirical equations, Japan, Hydrologic models.

xperiments using colored sand and gravel as tracers in a laboratory flume show that irregular and intermittent movement of sand and gravel in a stream can be simulated by a stochastic model. The stochastic model and experimental results show that the distribution of traveling distance of a single step of sand grains can be described by an exponential function. Relations between the average traveling distance of a single step and the probability for the beginning of movement of sand grains per unit time, and the parameter of flow intensity are discussed. Empirical formulas based on the tracer experiments are proposed for estimating average traveling velocity and bedload discharge of sand and gravel for the regime of flat beds. (USBR)
W70-09024

AN ELECTRO-OPTICAL PROBE FOR MEASUREMENT OF SUSPENDED SEDIMENT CONCENTRATION,
Iowa Univ., Iowa City.
Protosh K. Bhattacharya, John F. Kennedy, and John R. Glover.
13th Congr Int Assn. Hydraul Res, Proc Vol 2, p 241-250, Aug-Sept 1969. 10 p, 6 fig, 2 ref.

Descriptors: Sediment concentration, *Sediment load, Sediments, Light waves, Sediment transport, *Suspended sediments, Measuring instruments, *Optical instruments, Optical properties, Turbidity, Light penetration, Instrumentation, Sedimentation.
Identifiers: Probes (Instruments), Optical measurements, Light beams, *Light-scattering method, Photometers.

A newly developed instrument for measuring suspended sediment concentration in situ in rivers, estuaries, and shoaling waves is described. The probe has a gallium arsenide diode as a light source and a silicon planar diode as a light sensor. The light is attenuated by the suspended sediment concentration; light attenuation is proportional to the sediment surface area per unit volume of the suspension, resulting almost exclusively from light scattering at particle surfaces. Probe circuitry and appurtenant instruments are described, and calibration and response characteristics are given. Frequency response is adequate for measuring turbulent fluctuations and periodic variations of sediment concentration. Some data obtained in steady uniform flow and in breaking waves are summarized. (USBR)
W70-09026

REDUCTION OF SEEPAGE LOSSES FROM IRRIGATION CANALS AS A RESULT OF SILTING,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 03F.
W70-09043

THE EFFECT OF BED-LOAD MOVEMENT ON THE VELOCITY DISTRIBUTION OF FLOW,
Kyoto Univ. (Japan); and Osaka Prefectural Technical Coll., Neyagawa (Japan).
Katsumasa Yano, and Atsuyuki Daido.
13th Congr Int Assn Hydraul Res, Proc Vol 2, p 325-332, Aug-Sept 1969. 8 p, 6 fig, 4 ref.

Descriptors: *Bed load, *Velocity distribution, Laboratory tests, Open channel flow, Hydraulic laboratories, *Sediment load, *Streamflow, Shear stress, Sediments, Particles, Hydraulics, Rotational flow, *Movable bed models, Rotation, Hydrology, Reynolds number, Turbulent flow, Saltation.
Identifiers: *Bedload movement.

The velocity distribution near the bed for bedload-laden flow deviates from the well-known logarithmic-velocity-distribution law. The deviation is caused by shear stress generated by the rotation of sediment particles. If liquid mass transport is caused by sediment rotation, a difference of momentum of the main flow direction generates between the upper and the lower layer of the rotation axis of the sediment particle. The difference of momentum is the stress component on an area element normal to the main flow axis. The shear stress caused by the sediment rotation must be added to Reynolds stress. Using the above hypotheses, a theory of velocity distribution was developed. Theoretical results showed that the velocity distribution for the bedload-laden flow holds a linear relation on the new semilogarithmic coordinates introduced to reflect the effect of shear stress caused by sediment rotation. Experimental results showed that the velocity in the regions affected and not affected by sediment are connected with one linear relation in the new semilogarithmic coordinates. The gradient of linear relation is derived. (USBR)
W70-09052

PLANT COVER, RUNOFF, AND SEDIMENT YIELD RELATIONSHIPS ON MANCOS SHALE IN WESTERN COLORADO,
Geological Survey, Denver, Colo.
F. A. Branson, and J. B. Owen.

Water Resources Research, Vol 6, No 3, p 783-790, June 1970. 8 p, 6 fig, 1 tab, 18 ref.

Descriptors: *Soil-water-plant relationships, *Rainfall-runoff relationships, *Sediment yield, Geomorphology, Topography, Correlation analysis, Drainage patterns (Geologic), Drainage density, Runoff forecasting, Hydrograph analysis, Streamflow forecasting, Colorado.
Identifiers: Plant cover-runoff-sediment yield relations, Grand Junction (Colorado).

Relationships between vegetation and hydrologic measurements for 17 watersheds near Grand Junction, Colorado, were subjected to correlation analyses. Six years of vegetation measurements, four vegetation measurement methods, and 15 years of hydrologic records were used in the analyses. Highly significant correlation coefficients were found for percent bare soil and runoff, but the relationships between bare soil and sediment yields were not statistically significant. Geomorphic parameters such as angle of junction, mean slope, drainage density, relief ratio, length-width ratio, and watershed area were more highly correlated with sediment yields than with runoff. Correlation coefficients for spring vegetation measurements and runoff were higher than for autumn measurements. First contact methods and step point vegetation measurement methods were superior to the loop method and the all contacts point method. Curves for the relationship of runoff to bare soil were strikingly different for three sets of watersheds from different precipitation zones. Bare soil measurements may provide rapid and inexpensive estimates of runoff for watersheds similar to the ones studied. (Knapp-USGS)
W70-09118

FLUME STUDIES OF THE SEDIMENT TRANSFER COEFFICIENT,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
Neil L. Coleman.
Water Resources Research, Vol 6, No 3, p 801-809, June 1970. 9 p, 5 fig, 3 tab, 17 ref.

Descriptors: *Sediment transport, *Suspended load, *Suspension, *Hydraulic models, Flumes, Bed load, Open channel flow, Alluvial channels.
Identifiers: Sediment transfer coefficient.

Flume experiments show that in open channel flow the sediment transfer coefficient increases with distance from the channel bed, reaching a maximum value at a distance from the bed equal to about 20% of the flow depth, and then tends to remain at a constant value up to the water surface. The experiments also yield evidence indicating that the sediment transfer coefficient is larger for larger particle sizes. (Knapp-USGS)
W70-09119

EFFECTS OF RAINFALL ON SETTLING VELOCITY OF SUSPENDED SEDIMENT IN QUIESCENT WATER,
Texas A and M Univ., College Station; and Florida Univ., Gainesville.
S. I. Bhuiyan, E. A. Hiler, and E. T. Smerdon.
Water Resources Research, Vol 6, No 3, p 810-817, June 1970. 8 p, 7 fig, 1 tab, 12 ref. FWPCA Grant WP-00757-03.

Descriptors: *Settling velocity, *Clays, *Impact (Rainfall), Turbulence, Suspension, Suspended load, Sediment transport, Deposition (Sediments).
Identifiers: Transmissometers.

Concentrations of kaolin and betonite clay suspensions with respect to time were determined in quiescent water by a transmissometer both with and without rainfall impinging on the surface. Rainfall caused significant increase in the settling velocity of sediments in quiescent water. The increase in the settling velocity was more for kaolin particles than for bentonite. Comparative results of the turbulent intensity at four depths caused by rainfall on the quiescent water surface are presented. (Knapp-USGS)
W70-09120

A SYSTEM FOR MEASURING TOTAL SEDIMENT YIELD FROM SMALL WATERSHEDS,
Forest Service (USDA), Flagstaff, Ariz. Rocky Mountain Forest and Range Experiment Station.
Harry E. Brown, Edward A. Hansen, and Norman E. Champagne, Jr.
Water Resources Research, Vol 6, No 3, p 818-826, June 1970. 9 p, 12 fig, 7 ref.

Descriptors: *Sampling, *Sediment load, *Sediment yield, Weirs, Dams, Instrumentation, Streamflow, Data collections, On-site data collections, Suspended load, Water analysis.
Identifiers: Sample splitters, Sediment samplers.

Design and calibration data are presented from eight sediment measuring installations that have been constructed and tested by the U.S. Forest Service on the Beaver Creek pilot watershed in Arizona. Each installation includes a low dam and basin to trap coarse sediments and a series of splitters that collect a representative portion of the suspended sediment leaving the basin. The first splitter, a Barnes runoff sampler, is a sharp edged slot extending downstream from the dam spillway. With a 12-foot-wide spillway it extracts a theoretical split of 1/600 of the total volume of flow. The second splitter, an inclined slot mounted at the lower end of the Barnes sampler, extracts a theoretical 0.1 sample. This sample, 1/6000, enters an intermediate storage tank that leads from the middle of the stream channel to a final storage tank on the bank. The third splitter is a single slot, extracting 0.1 sample, mounted below a small rectangular weir in the end of the intermediate tank. The slot, which carries a 1/60,000 sample, enters the final storage tank. Calibration data are presented to characterize sampler performance, and a procedure is outlined for calculating total sediment yield. Errors in estimating total sediment are usually less than 18%. (Knapp-USGS)
W70-09121

STREAM ORDER AS A MEASURE OF SAMPLE SOURCE UNCERTAINTY,
South Carolina Univ., Columbia.
W. E. Sharp.
Water Resources Research, Vol 6, No 3, p 919-926, June 1970. 8 p, 3 fig, 3 tab, 13 ref.

Descriptors: *Drainage patterns (Geologic), *Channel morphology, *Geomorphology, *Sampling, Statistical methods, Topography, Data collections, Statistics, Stochastic processes, Markov processes, Probability, Path of pollutants.
Identifiers: Stream order, Bifurcation ratio.

The Horton stream order at the outlet of a drainage basin is a direct measure of the uncertainty (entropy) of the source supplying any discrete particle or atom detected at the outlet. If m is the order of the main stream in a basin, the uncertainty that the source lies in the drainage area of an ith order tributary is given by m - i. This may be interpreted as representing the minimum number of tests or samples needed to find a single contamination source in a sequential search of a drainage basin. Similarly Scheidegger's consistent stream order may be interpreted as being the number of samples required to search a basin for a single source when the link magnitude of the outlet is known. Because natural streams usually have multiple contaminant sources and cannot be expressed as a single branching process, a convenient estimate of the average nunber of samples needed to find a single source is given by (r - 1) (m - i) where r is the bifurcation ratio. (Knapp-USGS)
W70-09202

NEW YORK METROPOLITAN REGION--A MAJOR SEDIMENT SOURCE,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
M. Grant Gross.
Water Resources Research, Vol 6, No 3, p 92
931, June 1970. 5 p, 1 fig, 1 tab, 20 ref.

Descriptors: *Sediment yield, *New York, *Citie
*Urbanization, *Waste disposal, Continental shel
Sludge disposal, Silts, Sands, Mud, Waste dump
Solid wastes, Dredging.
Identifiers: New York Metropolitan Region.

Approximately 9.6 million tons per year of was
solids, including dredged sediment and construc
tion debris from the New York metropolitan r
gion, was dumped in New York Bight and
western Long Island Sound between 1964 ar
1968. This was apparently the largest sedime
source discharging directly into the North Atlant
Ocean (excluding the Gulf of Mexico) from th
North American continent. Considering the co
metropolitan region (population about 9 millio
as the dominant source, the average annu
discharge was about 1 ton per person (equivale
to about 6 pounds per person per day). (Knap
USGS)
W70-09203

CALIBRATION OF WALNUT GULCH SUPER CRITICAL FLUMES,
Agricultural Research Service, Stillwater, Okl
Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02E.
W70-09218

VISUAL OBSERVATIONS OF SUSPENDE PARTICLE DISTRIBUTION AT THREE SITE IN THE CARIBBEAN SEA,
Naval Oceanographic Office, Washington, D.C
Deep Vehicles Branch.
J. M. Costin.
Journal of Geophysical Research, Vol 75, No 21, 4144-4150, July 20, 1970. 7 p, 4 fig, 11 ref.

Descriptors: *Suspended load, *Atlantic Ocea
Particle size, Turbidity, Sampling, Data collection
Submarines, Density, Stratification, Densit
stratification.
Identifiers: Caribbean Sea.

Maxima and minima in concentrations o
suspended particulate matter were observed fro
the manned submersible Deepstar-4000 at thre
dive sites in the western Caribbean area. Althoug
depths of observed particulate maxima were di
ferent in each area, the layers of densest partic
concentration were found between the 9 deg C an
12 deg C isotherms. This temperature level
generally coincident with the boundary betwee
water of the Subtropical Undercurrent and Suba
tarctic Intermediate Water. It is believed that part
cle layers are a common feature of Caribbea
stratification and result from low particle settlin
velocities, sediment erosion, and decreased vertica
mixing at the depth of the thermal boundary. (K
napp-USGS)
W70-09231

DEPOSITION OF FINE-GRAINED SUSPENDE SEDIMENT FROM TIDAL CURRENTS,
University of East Anglia, Norwich (England)
School of Environmental Sciences.
For primary bibliographic entry see Field 02L.
W70-09232

A SUMMARY OF PRELIMINARY STUDIES O SEDIMENTATION AND HYDROLOGY I BOLINAS LAGOON, MARIN COUNTY CALIFORNIA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W70-09235

AGE OF QUATERNARY SEDIMENTS AN SOILS IN THE SACRAMENTO AREA

ALIFORNIA BY URANIUM AND ACTINIUM RIES DATING OF VERTEBRATE FOSSILS,
alifornia Univ., Davis. Kearney Foundation of il Science; and California Univ., Davis. Dept. of ils and Plant Nutrition.
O. Hansen, and E. L. Begg.
rth and Planetary Science Letters, Vol 8, No 6, p 1-419, July 1970. 9 p, 3 fig, 2 tab, 19 ref.

escriptors: *Radioactive dating, *Soils, *Sedients, *California, Uranium radioisotopes, adioisotopes, Alluvium, Radioactivity techniques, eistocene epoch, Soil water movement, aching.
entifiers: Fossils, Vertebrate fossils.

nethod of dating sediments and soils is proposed ich utilizes a uranium and actinium series dating buried vertebrate fossils. The method dates the verbank Formation east of Sacramento, Californ, and the overlying San Joaquin soil as 103,000 us or minus 6,000 years. The age is in accordance th cited geological evidence. Chronological grations of uranium, uranium-uptake and aching are related to moisture conditions and rdpan formation. In absence of groundwaters, wer migrations of uranium in rain waters netrating the soil profiles results in mean relence times of uranium within fossils to be less an the total elapsed time. Where groundwater s been present, absorption of uranium by fossils s rapid, the mean residence times of uranium are gher and equal to total elapsed time. U-234/U-8 ratios are lower in the wetter zones where ater facilitates some remixing of uranium otopes. Losses of uranium from some of the fos-s are related to carbonate leaching. (Knapp-SGS)
70-09239

OMPUTATION OF THE DEFORMATION OF ARS AND NAVIGATION CHANNELS,
kademiya Nauk Uzbekskoi SSR, Tashkent. Institut Matematiki.
u. T. Borshchevskiy, and A. A. Shakirov.
ranslated from Bulletin of the Academy of iences of the Uzbek SSR, Technical Sciences Se-es (Izv. Akad, nauk UzbSSR, ser. tekh. nauk), No p 52-55, 1969. Soviet Hydrology: Selected apers, Issue No 2, p 192-195, 1969. 4 p, 6 ref.

escriptors: *Sedimentary structures, *Channel orphology, *Sand waves, *Sand bars, Streamow, Sediment transport, Sedimentation, ischarge (Water), Sediment discharge.
entifiers: USSR.

method is given for computing river bar deforations on the basis of the theory of motion of two-hase flows. It was established theoretically and onfirmed by the results of field and model obser-ations. Data required for computation are net diment transport rate, sediment transport elocity, amplitude of channel bottom structures, ater discharge, and channel width. (Knapp-SGS)
70-09256

VATER BALANCE AND SILTING OF SMALL ESERVOIRS IN THE CENTRAL CHERNOZEM OF THE RUSSIAN SOVIET FEDERAL OCIALIST REPUBLIC.

ranslated from Russian. US Agricultural Research ervice, Washington, 1967. 403 p.

escriptors: *Water balance, *Sedimentation, Silting, *Reservoir silting, Lakes, Ponds, River asins, Infiltration, Mapping, Evaporation, Streamow, Turbidity currents, Erosion, Bottom sedients, Evaluation, Chernozems.
dentifiers: *USSR, *Central Chernozem region.

his 12-paper collection summarizes some of the esults of investigations carried out in 1956-1961 y the Laboratory of Limnology, Academy of ciences, USSR, and studies by other organizations of the regime of small rivers and reservoirs in the Central Chernozem Provinces. The paper by G. V. Lopatin gives information on the number, sizes and uses of reservoirs in the provinces and thoughts on further development of reservoirs on the national economy. Papers by I. P. Sukharev, A. M. Green and G. V. Nazarov, and by I. N. Sarokin discuss runoff characteristics of small drainage basins in the Central Chernozem Provinces. Water balance and hydrochemistry of small reservoirs are described in three papers. The papers by Ya. K. Kovalev, V. Ya. Frolov and L. V. Yakovlena relate to erosion, river sediment load and sediment accumulation. (See also W70-09313 thru W70-09315) (Lang-USGS)
W70-09312

THE BALANCE METHOD OF COMPUTING SEDIMENT FLOW AND ESTIMATING THE RATE OF SILTING OF RESERVOIRS,
A. F. Kudryoshov.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic, US Agricultural Research Service, p 374-403, 1967. 30 p, 4 fig, 5 tab, 25 ref.

Descriptors: *Silting, *Sedimentation rates, *Reservoirs, *Ponds, *Lakes, Sediment load, Mathematical studies, Estimating, Hydrologic properties, Discharge (Water), Suspended load, Rivers, Bottom sediments, Eddies, Agriculture, Gaging stations, Velocity, Particle size.
Identifiers: *USSR, Chernozem Provinces.

This study presents an analytical and experimental analysis of the application of the balance method for estimating reservoir silting using hydrogeological data recorded at a few reservoirs of the Mzymta River, USSR. The discussion includes: experience in the use of the balance method of estimating sediment flow; physical meaning of the Lakhtin number, and estimating the rate of reservoir silting. Several tables present the distribution of volume-weights of bottom sediments and the granulometric, specific gravity, and other pertinent characteristics of reservoir sediment flows. (See also W70-09312) (Gabriel-USGS)
W70-09315

MORPHOLOGY OF GULLIES IN THE COLORADO ROCKY MOUNTAINS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 04D.
W70-09372

INFLUENCE OF RAINFALL ENERGY ON SOIL LOSS AND INFILTRATION RATES: 2. effect of clod size distribution,
Agricultural Research Service, Ames, Iowa; and Iowa State University, Ames.
For primary bibliographic entry see Field 02G.
W70-09378

ISOPACHOUS MAPPING OF THE LOWER PATUXENT ESTUARY SEDIMENTS BY CONTINUOUS SEISMIC PROFILING TECHNIQUES,
Naval Oceanographic Office, Washington, D.C. Coastal Oceanography Branch.
For primary bibliographic entry see Field 02L.
W70-09390

EFFECTS OF EFFLUENT AND INFLUENT SEEPAGE ON THE HYDRODYNAMIC FORCES ACTING ON AN IDEALIZED NONCOHESIVE SEDIMENT PARTICLE,
Utah State Univ., Logan. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09410

WATER EROSION, THE FORMING OF SEDIMENT FLOW OF SMALL STREAMS IN THE CENTRAL CHERNOZEM PROVINCES AND MEASURES FOR PROTECTING RESERVOIRS FROM SILTING,
V. Ya Frolov.
Translated from Russia. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic, U S Agricultural Research Service p 204-305, 1967. 102 p, 7 fig, 15 tab, 177 ref, 3 append.

Descriptors: *Erosion, *Erosion control, *Silting, *Sedimentation, *Sediment control, *Reservoirs, Reservoir silting, Lakes, Soil erosion, Agricultural watersheds, Runoff, Seasonal, Forests, Turbidity, Discharge (Water), Mathematical studies, Mapping, Rivers.
Identifiers: *USSR, Chernozem Provinces.

This is a comprehensive and detailed study of the erosion, sedimentation, and measures for erosion and siltation control of small reservoirs and streams of the Chernozem Provinces of the USSR. Soil erosion and the sediment flows of small streams in the Chernozem territory depends on many physical and geographic factors including relief, climate, soil, vegetarion, and others. The principal part of water and sediment flow of small streams is formed during the spring high-water period. Water erosion from fall-plowed land and from winter crops is about the same. The average rate of sediment flow of small streams is about 1.2 to 2.4 tons/hour. Comparison of accepted theoretical and experimental calculation of sediment runoff shows that the discrepancies between the computed and measured values were on the average greater than 50 to 100 percent. The use of empirical formulas for the long-term annual turbidities should considerably minimize these discrepancies. Reduction of inflow of sediment into a reservoir must take into consideration the administrative, economic, phytometeorative and hydrotechnical factors of the territory. (See also W70-09312). (Gabriel-USGS)
W70-09414

TURBIDITY OF RIVERS AND ITS DISTRIBUTION IN THE CENTRAL CHERNOZEM PROVINCES,
Ya. K. Kovalev.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic; collection of papers translated for U S Agricultural Research Service, p 187-203, 1967. 17 p, 4 fig, 1 tab, 10 ref.

Descriptors: *Turbidity, *Rivers, *Sediment yield, *Streamflow, Erosion, River basins, Mapping, Sediments, Suspended load, Forests, Seasonal, Snow, Topography, Geology, Floods, Precipitation (Atmospheric), Vegetation.
Identifiers: *USSR, Chernozem Provinces.

The average turbidity of rivers in the Central Chernozem Provinces, of the USSR were investigated and average long-term turbidity versus catchment area curves for four turbidity zones (20-50 g/cu m, 50-100 g/cu m, 100-200 g/cu m, and 200-500 g/cu m) were drawn. On the basis of these studies the map of the zones of average turbidity for the rivers of the Central Chernozem Provinces was constructed. The turbidity determined from this map should provide better information for the distribution of erosion processes in the territory and for the design of erosion control measures. (See also W70-09312). (Gabriel-USGS)
W70-09416

CHARACTERISTICS OF SILTING OF SMALL RESERVOIRS OF THE CENTRAL CHERNOZEM PROVINCES AND COMPUTATION OF DENSITY OF BOTTOM DEPOSITS,
L. V. Yakovleva.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic; collection of papers translated for U S Agricultural Research Service, p 306-329, 1967. 24 p, 4 fig, 5 tab, 19 ref.

Descriptors: *Reservoirs, *Lakes, *Ponds, *Silting, *Sedimentation, *Sedimentation rates, Mapping, Turbidity, Sediment transport, Erosion, River basins, Particle size, Organic matter, Mathematical studies, Sands, Silt, Clays, Sedimentary petrology.
Identifiers: *USSR, Chernozem Provinces.

Silting of 44 small reservoirs in the Chernozem Provinces of the USSR was investigated analytically and experimentally by using the Lane-Koelzer formula, the Miller formula, and the Drozd-Myalkovskiy formula. A comparatively good agreement between values computed by Miller's formula and actual values was obtained for the ponds of up to 75 years of age, whereas the use of the Drozd-Myalkovsky formula resulted in errors up to 50% and more for old ponds. Large deviation from actual values was recorded by using the Miller and Drozd-Myalkovskiy formulas for a reservoir only 6 years old and for one 65 years old. (See also W70-09312). (Gabriel-USGS)
W70-09417

DEVELOPING A METHOD OF COMPUTING SILTING OF SMALL RESERVOIRS IN THE CENTRAL CHERNOZEM PROVINCES,
Leningrad State Univ. (USSR). Limnology Lab.
G. V. Lopatin.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic, p 330-358, 1967. 29 p, 5 fig, 4 tab, 20 ref.

Descriptors: *Silting, *Sedimentation, *Reservoirs, *Ponds, *Lakes, *Mathematical studies, Erosion, Water supply, Discharge (Water), Sedimentation rates, Abrasion, Precipitable water, Industrial wastes streamflow, Turbidity, Statistical methods, Water loss.
Identifiers: USSR, Chernozem Provinces.

After briefly discussing the causes inducing the precipitation of various substances in small reservoirs the author describes and analyzes the principal methods of computing silting in small reservoirs, the dependence of the trap efficiency of a reservoir on the degree of regulation of water flow and gives a few nomograms of silting whose construction is based on a few simple analytical expressions. The nomograms permit the computation of the value of the average annual loss of reservoir capacity for some period of time (T) by knowing the average annual turbidity of the water flow, the average volume-weight of the deposits, and the ratio of two indices, a and b. An example of using the nomograms is given. (See also W70-09312). (Gabriel-USGS)
W70-09418

EROSION CONTROL ON ROADSIDES IN TEXAS,
Texas Transportation Inst., College Station.
Wayne G. McCully, and William J. Bowmer.
Available from NTIS as PB-191 353, $3.00 in paper copy, $0.65 in microfiche. Texas Transportation Institute Research Report 67-8 (final), July 69. 37 p.

Descriptors: *Erosion control, Roadbanks, Vegetation establishment, Road construction, Planting management.

A progress report is made of a study recommending practices for vegetation establishment (seed mixtures, fertilizers, liming, soil preparation, planting dates and mulching) in various climatic and geographical regions in Texas. Tables indicating seed mixtures and planting dates for clay and sandy soil textures with a map designating geographical areas is included for reference. Illustrations, depicting methods, equipment operation and results of some experiments are included in the report. (BPR)
W70-09451

2K. Chemical Processes

A STUDY OF THE HYDROCHEMICAL FACIES OF THE WILCOX AQUIFERS IN MISSISSIPPI,
Mississippi State Univ., State College. Water Resources Research Inst.
Donald M. Keady.
Available from NTIS as PB-193 685, $3.00 in paper copy, $0.65 in microfiche. Completion Report, July 1970. 42 p, 8 tab, 14 fig, 22 ref. OWRR Project A-038-MISS (1).

Descriptors: *Groundwater, *Dissolved solids, *Aquifer characteristics, *Chemical analysis, *Carbonates, Water quality, Iron, Mississippi, Aquifers, Geochemistry, Geologic formations, Calcium carbonate, Chlorides.
Identifiers: *Facies, Hydrochemical facies, Wilcox aquifers, Sodium carbonate.

The original concept of hydrochemical facies is modified using a simple linear model that is consistent with the definition of a facies. The model provides useful numerical parameters derived from the samples available. A set of 244 samples from the Wilcox and Meridian-Wilcox aquifers yielded eight significant hydrochemical facies containing 186 of the samples. The exclusion of the remaining samples indicates the sensitivity of the model. The eight facies are of the same general classes of water expected in sand aquifers in the coastal plain, but their characteristics are more closely defined. Maps showing the distribution of the facies reflect the geologic setting of the aquifers and the modification of the chemical quality of the water. From the outcrop down the dip the facies change from calcium-bicarbonate types to sodium-bicarbonate types to sodium-bicarbonate-chloride types. A large area of high quality sodium-bicarbonate water is present in the aquifers, especially in the Meridian-Wilcox. Other measures of water quality can be related to the hydrochemical facies in some cases, but many require separate study. Maps of the distribution of dissolved iron show several large areas where iron content is exceptionally high, especially in the Meridian-Wilcox aquifer. (Keady-Mississippi State)
W70-09095

CHEMICAL COMPOSITION OF THE ICE OF OTKAZNENSKIY RESERVOIR,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
I. M. Korenovskaya, and M. N. Tarasov.
Translated from Hydrochemical Materials (Gidrokhimicheskiye Materialy), Vol 49, p 25-38, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 149-160, 1969. 12 p, 2 fig, 1 tab, 17 ref.

Descriptors: *Water chemistry, *Ice, *Freezing, *Reservoirs, *Iced lakes, Lake ice, Aqueous solutions, Limnology, Water quality, Solutes, Geochemistry.
Identifiers: Reservoir ice, Ice chemical composition.

The chemistry was studied of ice formation in a reservoir in the USSR. The purposes of the investigation were to trace the change in the mineralization and chemical composition of the ice with time to determine the degree of vertical and horizontal distribution of the chemical characteristics of the ice cover of the reservoir, and to establish quantitatively how ice formation affects the increase in water mineralization during freeze-up. In the winter of 1967, the mineralization of the ice on Otakznenskiy Reservoir decreased gradually from 360 to 60 mg/liter by a factor of 6. Although the mineralization of the under-ice water was spatially uniform, ice composition differed in the vertical and horizontal directions. The mineralization of the upper ice layers was 3-10 times higher than that of the lower and differed at individual stations by a factor of 1.5-3.4. Despite the uneven mineralization of the ice, the average relative chemical composition remained practically constant with time and over the area. The ice formation process has a marked influence on the change in the mineralization of the water of the reservoir. Owing to this factor, water mineralization increased by 8% in the course of a month. (Knapp-USGS)
W70-09097

HYDROCHEMICAL REGIME AND SALT BALANCE OF OTKAZNENSKIY RESERVOIR IN THE FIRST YEAR OF ITS EXISTENCE (1966),
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
I. M. Pavelko, and M. N. Tarasov.
Translated from Hydrochemical Materials (Gidrokhimicheskiye Materialy), Vol 49, p 48-54, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 160-166, 1969. 7 p, 3 fig, 2 tab, 9 ref.

Descriptors: *Water chemistry, *Water balance, *Reservoirs, *Salt balance, Water quality, Arid lands, Evaporation, Leaching, Seepage.
Identifiers: USSR, Otkaznenskiy Reservoir, Kuma River.

The morphometry, water balance, and chemical balance in the first year of the Otkaznenskiy Reservoir, USSR, are described. Systematic investigations of the hydrochemical regime of the reservoir were begun in April 1966. The year-round hydrochemical investigations included monthly observations of the elements of the salt balance of the reservoir (the supply of salts from the atmosphere, river and groundwater, and also the loss of salts by water discharge into the lower pool, seepage through the dam body, etc.). Before the reservoir was filled in July 1965, a soil survey was made of its bed and water extracts were analyzed to establish soil salinity and its effect on the salt balance of the reservoir. Before the reservoir was built, the mineralization of the Kuma River fluctuated from 600 to 1700 mg/liter in the course of a year. The range of variations in the mineralization of the reservoir is less broad, 800-1500 mg/liter. The chemical composition of the river water was sulfatic over most of the year, except during summer floods, when the bicarbonate ion predominated in the anion composition. The Ca, Na + K ions predominated in the cation composition. The chemical composition of the reservoir water is of sodium-sulfate type. The hydrochemical regime of the Kuma River changed from a Na-Ca-K sulfate to a predominantly Na-sulfate type as a result of its regulation by the Otkaznenskiy Reservoir in the first year of its existence. The salt balance of the reservoir shows as its main elements the supply of salts from river flow (88%) and the discharge of salts into the lower pool of the reservoir (70%). Such elements as the supply of salts from the reservoir bed (6.0%) and their removal with seepage water (20.7%) are also important in the first year of existence of a reservoir. (Knapp-USGS)
W70-09098

OBSERVATIONS ON ACTIVITY AND DIFFUSION COEFFICIENTS IN NA-MONTMORILLONITE,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
P. F. Low.
Research supported by a grant from the Div of Agr Development, Tennessee Valley Authority. Israel Journal of Chemistry, Vol 6, p 325-336, 1968. 12 p, 7 fig, 4 tab, 15 ref.

Descriptors: *Clay minerals, *Montmorillonite, *Ion transport, *Diffusion, Viscosity, Porosity, Water chemistry, Mineralogy, Clays.
Identifiers: Clay-water systems.

Double-layer theory was used to obtain the distribution of electrical potential between adjacent clay particles. From this distribution, the activity coefficients of the sodium and chloride ions in the system were calculated. The porosity of the clay-water system was calculated from the density and

ıcentration of clay, and the calculated value was ed to calculate the geometry factor. This factor d the diffusion coefficient of water in bulkwater re used to calculate the diffusion that water uld have in the clay if the water therein had its rmal viscosity. The water in the clay was about ce as viscous as normal water. It was possible to mpute the diffusion coefficients that Na and Cl uld have in the absence of electrical interaction h the clay. To obtain closer agreement, electri- field strengths calculated by double-layer ory were used in an empirical equation relating cosity and field strength to obtain the distribu- n of viscosity relative to the particle surfaces. so, double-layer theory was used to obtain ionic tributions with respect to these surfaces. From resulting distributions it was possible to deter- ne, the ionic diffusion coefficients that should tain in the clay system. (Knapp-USGS)
70-09105

DROCARBONS IN THERMAL AREAS, RTHWESTERN WYOMING,
ological Survey, Washington, D.C., and Na- nal Park Service, Washington, D.C.
D. Love, and John M. Good.
r sale by Superintendent of Documents, U S vernment Printing Office, Wash, D C 20302 - ce $0.40 (paper cover). U S Geological Survey ofessional Paper 644-B, P B1-B23, 1970. 23 p, fig, 1 tab, 36 ref.

scriptors: *Thermal springs, *Distillation, *Oily ter, *Wyoming, Hot springs, Thermal water, eam, Organic matter, Sedimentary rocks, Bitu- nous materials.
entifiers: Hydrocarbons, Yellowstone National rk.

ve natural occurrences of hydrocarbons in ther- l areas lie in an arcuate southeastward-to east- rd-trending area 70 miles long in northwestern yoming. The westernmost three are in Yel- wstone National Park. All are associated with undant sulfur and thermal springs and vents. ur are surrounded and underlain by volcanic cks, which range in age from Eocene to eistocene. The fifth emerges from Paleozoic ata. The source of the hydrocarbons could be leozoic or Mesozoic sedimentary rocks that un- rlie the surficial volcanics, but at Rainbow rings the oil might have been distilled from eistocene nonmarine algae at shallow depth. Sul- r isotope analyses do not indicate conclusively nether the sulfur is of igneous or bacteriogenic igin. In at least two of the localities, hot water d steam that derive their heat from an igneous urce below the sediments are believed to relate rectly to the extraction of the hydrocarbons, ansport upward along conduits, and extrusion on e surface. (Knapp-USGS)
70-09108

LEMENTAL SULFUR IN EDDY COUNTY, EW MEXICO,
eological Survey, Washington, D.C.
m S. Hinds, and Richard R. Cunningham.
vailable free on application to the US Geological rvey, Wash, DC, 20242. US Geological Survey ircular 628, 1970. 13 p, 4 fig, 10 ref.

escriptors: *Sulfur, *New Mexico, *Water emistry, Reduction (Chemical), Hydrogen sul- de, Sulfates, Gypsum, Water circulation, Ground- ater, Chemical reactions, Carbonate rocks, roundwater movement.
dentifiers: Eddy County (N. Mex).

ulfur has been reported in Eddy County, N. Mex., rocks ranging from Silurian to Holocene in age at epths of 0-15,020 feet. Most of the reported sulfur ccurrences are in the Abo, Yeso, and San Andres ormations and the Artesia Group. Sulfur deposi- on in the dense dolomites of the Abo, Yeso, and an Andres Formations is attributed to the reduc- on of ionic sulfate by hydrogen sulfide in forma- on waters in zones of preexisting porosity and permeability. A similar origin accounts for most of the sulfur deposits in the formations of the Artesia Group, but some of the sulfur in these formations may have originated in place through the alteration of anhydrite to carbonate and sulfur by the metabolic processes of bacteria in the presence of hydrocarbons. Sulfur deposits in the Castile Formation are found in irregular masses of cavernous brecciated secondary carbonated rock enveloped by impermeable anhydrite. Formation of carbonate rock and sulfur in the castiles is attributed to the reduction of brecciated anhydrite by bacteria and hydrocarbons in the same process ascribed to the formation of carbonate and sulfur in the caprocks of salt domes. (Knapp-USGS)
W70-09128

CHEMICAL COMPOSITION OF PRECIPITATION IN REGIONS OF THE SOVIET UNION,
Main Geophysical Observatory, Leningrad (USSR).
For primary bibliographic entry see Field 02B.
W70-09133

CHEMICAL HYDROLOGY OF REGIONS OF EAST ANTARCTICA,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
A. A. Matveev.
Journal of Geophysical Research, Vol 75, No 18, p 3686-3690, June 20, 1970. 5 p, 4 tab, 4 ref.

Descriptors: *Chemistry of precipitation, *Antarctic, Ice, Snow, Sampling, Data collections, Water chemistry, Precipitation (Atmospheric), Runoff, Ablation.
Identifiers: USSR.

Samples of atmospheric precipitation, snow, and ice were collected during the IGY in East Antarctica. The chemical composition of the precipitation and of the snow and ice cover is influenced by the relief and climatic features of the antarctic continent. Three distinctive zones can be identified in East Antarctica: the coastal strip, the oasis, and the inland region. The main feature of the chemical hydrology of the coastal strip is its comparatively high concentration of substances in precipitation, which ranged from 3.3 to 260.8 mg/l. The composition of atmospheric precipitation in this zone is influenced by the ocean. The relation of changes in the concentration of precipitation constituents to the dynamics of air masses over the region of observation, as well as to position of the drifting ice edge, was investigated. Precipitation in the ice-free surface area of the Antarctic oasis region is characterized by a predominance of HCO3, Na, K, and CA ions. Fluctuations in the snow mineralization are 1 to 4 mg/l in this zone. Snow differs from that of the coastal strip by variations in ion concentrations. Calculation of the chemical ice runoff showed some excess in the accumulation of salts by precipitation over runoff. (Knapp-USGS)
W70-09134

COMPOSITION OF WATER IN CLINCH RIVER, TENNESSEE RIVER, AND WHITEOAK CREEK AS RELATED TO DISPOSAL OF LOW LEVEL RADIOACTIVE LIQUID WASTES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-09194

EXPERIMENTS ON THE ADSORPTION OF AMMONIUM IONS BY CLAY PARTICLES IN NATURAL WATERS,
Oklahoma State Univ., Stillwater. Reservoir Research Center.
Dale W. Toetz.
Water Resources Research, Vol 6, No 3, p 979-980, June 1970. 2 p, 1 tab, 4 ref. Project A-001-Okla.

Descriptors: *Adsorption, *Clay minerals, *Ion exchange, Ions, Turbidity, Geochemistry, Water chemistry, Water quality, Suspended load, Laboratory tests.
Identifiers: Clay-solute interactions.

The situation where the counter ion NH4 on particulate matter establishes a dynamic equilibrium with other cations in surface waters was simulated experimentally by mixing a powdered subsoil and a montmorillonite, respectively, with diluted well water. Adsorption was demonstrated in one case, but the employed technique lacked the sensitivity needed to measure adsorption of NH4 at concentrations normally encountered in freshwater. (Knapp-USGS)
W70-09211

A MODIFICATION OF THE BENZENE SYNTHESIS METHOD FOR TRITIUM ANALYSIS,
Florida State Univ., Tallahassee.
Edward I. Wallick, and George A. Knauer.
Water Resources Research, Vol 6, No 3, p 986-988, June 1970. 3 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Tritium, *Water analysis, Analytical techniques, Laboratory tests, Radioisotopes, Chemical analysis.
Identifiers: Benzene synthesis.

A modification of the benzene synthesis method for tritium analysis by liquid scintillation counting is suitable for limited production of hydrologic samples. Procedures are described for elimination of sulfide quenching of the benzene and optimization of the acetylene-benzene conversion. Tritium isotopic fractionation is constant during benzene synthesis with a loss of (19.3 plus or minus 0.2)% of the water sample tritium activity. Cross checks with other laboratories agree within counting statistical error. (Knapp-USGS)
W70-09213

CHEMICAL CHARACTERISTICS OF WATER MASSES IN THE AMERASIAN BASIN OF THE ARCTIC OCEAN,
Alaska Univ., College. Inst. of Marine Science.
Patrick Kinney, Martin E. Arhelger, and David C. Burrell.
Journal of Geophysical Research, Vol 75, No 21, p 4097-4104, July 20, 1970. 8 p, 12 fig, 20 ref. ONR Contract N000 14-67-A-3017-0001.

Descriptors: *Water chemistry, *Arctic ocean, *Ocean circulation, Water temperature, Salinity, Dissolved oxygen, Nutrients, Density, Density stratification, Thermal stratification, Mixing, Advection, Oxidation, Ocean currents, Oceanography.
Identifiers: Amerasian basin.

Detailed vertical profiles of hydrographic data and routine chemical parameters (oxygen, nutrients) were taken in the Amerasian basin of the Arctic Ocean and in the Bering Strait and Chukchi Sea. Correlations of these chemical profiles with water mass sources and mixing processes are postulated. The water of the sharp temperature maximum at about 75-meter depth is chemically a mixture of the arctic surface water and core water from about 160 meters. This core water corresponds to the temperature minimum and nutrient maximum and is of Bering Strait-Chukchi Sea origin. The temperature maximum and minimum simply reflect differing thermal regims existing in the Chukchi. Extremely close vertical sampling has shown intriguing detail in the oxygen, temperature, salinity, and nutrient profiles in the area of the very sharp oxygen minimum occuring at about 205 meters. Temperature-salinity and chemical plots of the close-interval data identify a core of water at approximately 230 meters that is mixing above with Bering core water at 160 meters and below with the Atlantic core water at about 500 meters. Thus the oxygen minimum appears to be at least partly due to advection of shelf water into the basin rather than to in situ oxidation alone. (Knapp-USGS)
W70-09230

LEAD IN A SUBURBAN ENVIRONMENT,
P. R. Atkins.
Journal Air Pollution Control Association, Vol 19, No 8, p 591-594, August 1969. 4 p, 14 ref.

Descriptors: *Air pollution, *Heavy metals, *Fallout, *Urbanization, Highway effects, Raindrops, Nucleation, Sediments, Particle size.
Identifiers: *Lead fallout, Highway traffic, Pollution source.

The lead content of air, rainfall, and dry fallout samples taken at several sites in Palo Alto, California are reported and discussed. Major source of lead pollution apparently is the high-speed, high-density freeway traffic in the area. The natural atmospheric cleansing processes of sedimentation and raindrop scavenging remove large quantities of lead particulate matter. Nucleation probably occurs on the submicronic lead compound particles in exhaust streams, making droplets which impact on the larger airborne particles. This could explain the wide size distributions range reported in the literature as well as the large amounts of lead found in the samples analyzed. (Lang-USGS)
W70-09251

EFFECTS OF SALTS AND ORGANIC MATERIALS ON THE HYDRAULIC CONDUCTIVITY OF THE SOILS,
National Taiwan Univ., Taipei. Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 02G.
W70-09290

DISSOLVED SOLIDS-DISCHARGE RELATIONSHIPS: 1. MIXING MODELS,
New Hampshire Univ., Durham.
Francis R. Hall.
Water Resources Research, Vol 6, No 3, p 845-850, June 1970. 6 p, 1 fig, 7 ref. OWRR A-002 NH.

Descriptors: *Water quality, *Streamflow, *Dissolved solids, *Mathematical models, Aqueous solutions, Solutes, Mixing, Leaching, Dispersion, Diffusion, Discharge (Water).
Identifiers: Discharge-dissolved solids relationships, Mixing models.

A reasonable basis is needed for the selection of models to aid in analyzing the relationships between dissolved constituents and discharge in streams. A series of simple mixing models based on mass balance calculations is presented along with derivations and solutions for assumptions about the mixing volumes and the storage volume-discharge relationship. If concentration and discharge data show a hysteresis or loop relationship with time, then the commonly assumed direct relationship between total volume of water in the stream channel and stream discharge is probably not valid. The relationship of the constants in the derived equations to physical or chemical factors is masked at the present time by the nature of the initial assumptions and the method of derivation. (Knapp-USGS)
W70-09311

A GEOCHEMICAL DRAINAGE SURVEY IN CENTRAL ECUADOR,
Kennecott Exploration del Ecuador, Quito; and Proyecto Minero, Quito (Ecuador).
Tjepke P. Kroon, and Ann de Grys.
Economic Geology, Vol 65, No 5, p 557-563, August 1970. 7 p, 3 fig, 3 ref.

Descriptors: *Surveys, *Geochemistry, *Exploration, *Trace elements, Water chemistry, Surface waters, Runoff, Streamflow, Leaching, Sediments, Mineralogy, Solutes, Sampling.
Identifiers: Ecuador.

A reconnaissance drainage sediment survey was carried out over 10,000 sq km in the Cordilleras of Central Ecuador. Long dispersion trains of zinc extend over several kilometers and are associated with shorter trains of Pb, As, Ag, Sb and Bi. These metals are derived from epithermal deposits containing galena, sphalerite, arsenopyrite and Ag-Sb-Bi sulfides. Very pronounced copper-molybdenum anomalies could be traced over long distances in streams of a major drainage basin. The anomalies were derived from the copper-molybdenum porphyry occurrence at Chaucha. Copper-zinc anomalies of moderate length derive from the oxidation of disseminated pyrite in andesitic volcanics. Zinc anomalies extend for 1-2 km in streams originating in the poorly drained highlands, or 'paramo.' Polymetallic anomalies of Cu, Zn, Mo, V, Ni, Co, and As are found in streams draining an area of black shales. (Knapp-USGS)
W70-09352

WATER TECHNOLOGY,
Rice (Cyrus Wm.) and Co., Pittsburgh, Pa.
For primary bibliographic entry see Field 03A.
W70-09361

HYDROCHEMICAL CHARACTERISTICS OF SMALL RESERVOIRS IN SOME DISTRICTS OF THE CENTRAL CHERNOZEM PROVINCES,
I. Ya. Degopik.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic, p 166-186, 1967. 21 p, 3 fig, 3 tab, 17 ref.

Descriptors: *Hydrologic aspects, *Hydrologic data, Chemical properties, *Reservoirs, *Ponds, Chernozems, Limnology, Silting, Reservoir silting, Rivers, Forests, Geology, Runoff, Seasonal, Gases, Carbon dioxide, Vegetation, Water chemistry, Bicarbonates, Chemical analysis.
Identifiers: *USSR, Chernozem Provinces.

Hydrochemical characteristics of the small ponds and reservoirs of Kursk Province, USSR were recorded and analyzed during 1956-1960. In general, the content of dissolved gases in the pond waters is subject to large variations, and the waters in the first years of their existence are characterized by absorption of dissolved oxygen and by a simultaneous increase in the content of carbon dioxide. The extreme values of mineralization are 62 and 646 mg/liter with the greatest number of investigated ponds having a narrow range of mineralization (150 to 250 mg/liter). The mineralization of ponds fed by groundwater does not reach high values and, on the average, does not exceed 400 mg/liter. (See also W70-09312). (Gabriel-USGS)
W70-09419

NITRATE VARIATION IN GROUNDWATER,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05A.
W70-09425

2L. Estuaries

TWO LAYER MODEL OF STRATIFIED FLOW IN AN ESTUARY,
Waterloopkundig Laboratorium, Delft (Netherlands).
C. B. Vreugdenhil.
La Houille Blanche, No. 1, 1970, p35-40, 9 fig, 3 tab, 12 ref.

Descriptors: *Density stratification, *Mathematical model, Saline water, Freshwater interfaces, Numerical analysis, Estuarines, Tidal effects, Velocity, Continuity equation, Water waves.
Identifiers: Rotterdam waterways, Boundary conditions, Interfacial friction.

A mathematical model was developed and computations were verified by means of prototype data from the Rotterdam Waterway of 1956. The data for computation included case A (with tidal computation) and case B (without tidal computation). By comparison of case A and case B, it was concluded that the horizontal tide is the main factor influencing the salt wedge. It was noticed that the vertical tide was 2 hours late in case B. A second important factor is the seaward boundary condition for the internal flow and the essential processes of supercritical in and outflow should be included. The evaluation of the correspondence between measurements and computations depends on the required accuracy. Results showed a reasonable reproduction of the layer-thickness and velocities. The method is considered to be useful for many practical purposes. Essentially, the value of the two-layer model is determined by the empirical parameter k (coefficient of interfacial friction) which can be estimated depending on the overall conditions of the estuary. (Hsieh-Vanderbilt)
W70-09152

RESEARCH NEEDS ON THERMAL AND SEDIMENTARY POLLUTION IN TIDAL WATERS.
American Society of Civil Engineers. Committee on Tidal Hydraulics of the Hydraulics Div.
For primary bibliographic entry see Field 05B.
W70-09161

ESTUARY ENTRANCE, UMPQUA RIVER, OREGON; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
G. M. Fisackerly.
Sponsored by U.S. Army Engineer District, Portland. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-70-6, May 1970. 20 p, 3 tab, 83 photo, 177 pl.

Descriptors: *Estuaries, *Hydraulic models, Shoals, Channel improvement, Jetties, Currents (Water), Oregon.
Identifiers: *Umpqua River, Navigation conditions.

Model was of fixed-bed type, constructed to scales of 1:300 horizontally and 1:100 vertically, reproducing the lower 28 miles of Umpqua River and an adjoining portion of the Pacific Ocean. Purpose of model study was to determine optimum plan for the reduction of shoaling and elimination of crosscurrents in the navigation channel at the entrance. Model verification tests indicated that the model hydraulic and salinity regimens were in satisfactory agreement with those of the prototype for comparable conditions, and therefore model provided quantitative answers concerning the effects of the proposed plans on the hydraulic and salinity regimens of the estuary. Optimum plan consisted of existing conditions plus a 2600-ft extension of the training jetty to the outer end of the south jetty. Results of model tests indicate that the optimum plan eliminated the crosscurrents without aggravating the wave climate or shoaling conditions. (Spivey-Waterways Experiment Station)
W70-09179

A NUMERICAL TECHNIQUE FOR CALCULATING THE TRANSIENT POSITION OF THE SALTWATER FRONT,
Geological Survey, Washington, D.C.
George F. Pinder, and Hilton H. Cooper, Jr.
Water Resources Research, Vol 6, No 3, p 875-882, June 1970. 8 p, 5 fig, 14 ref.

Descriptors: *Saline water intrusion, *Aquifers, *Mathematical models, *Numerical analysis, Groundwater movement, Saline water-freshwater interfaces, Unsteady flow, Mixing, Diffusion, Permeability, Viscosity.
Identifiers: Saltwater front (Aquifers).

The movement of the saltwater front in coastal aquifers, including the effect of dispersion, can be determined by using numerical methods. The method of characteristics is used to solve the solute transport equation, and the alternating direction iterative procedure is used to solve the groundwater flow equation for the two-dimensional

blem. This approach permits the treatment of sient flow in nonhomogeneous aquifers with ir- ilar geometry. (Knapp-USGS)
0-09196

ME EFFECTS OF FRESH-WATER INFLOW THE FLUSHING OF SOUTH SAN FRAN- CO BAY: A PRELIMINARY REPORT,
logical Survey, Washington, D.C.
primary bibliographic entry see Field 05G.
0-09215

VEMENT OF SEABED DRIFTERS IN THE FRANCISCO BAY ESTUARY AND THE JACENT PACIFIC OCEAN: A PRELIMINA- REPORT,
logical Survey, Washington, D.C.
Conomos, D. H. Peterson, P. R. Carlson, and McCulloch.
ilable free on application to the U S Geological vey, Washington, DC 20242. In: A Preliminary dy of the Effects of Water Circulation in the San ncisco Bay Estuary, U S Geological Survey Cir- r 637-B, p B1-B8, 1970. 4 fig, 2 tab, append.

criptors: *Estuaries, *Bays, *Water circulation, rrents (Water), *California, Aquatic drift, es, Current meters, Drift bottles, Drifting uatic).
ntifiers: *San Francisco Bay.

movement of near-bottom water is of con- rable importance in transporting suspended erials between the Pacific Ocean and the San ncisco Bay system. Owing primarily to tidal v, the movement of near-bottom water may be illatory. There is, however, a residual drift. To cribe this residual drift, the U. S. Geological vey is releasing seabed drifters bimonthly within San Francisco Bay system and on the continen- shelf of central California from Cape Men- ino to Point Conception. From southern San lo Bay to northern San Francisco Bay, domi- nt movement was to the north and west, with ximum transport distances of 40 km. In south Francisco Bay, little apparent net movement no prevalent direction was measured. (Knapp- GS)
0-09216

SPERSION IN HOMOGENEOUS ESTUARY OW,
nois Univ., Urbana; Massachusetts Inst. of Tech. mbridge; and California Univ., Berkeley. Dept. Civil Engineering.
ward R. Holley, Donald R. F. Harleman, and go B. Fischer.
CE Proceedings, Journal of the Hydraulics Divi- n, Vol 96, No HY8, Paper 7488, p 1691-1709, gust 1970. 9 p, 6 fig, 1 tab, 33 ref, append. NSF ant GK-3210.

scriptors: *Dispersion, *Estuaries, *Path of pol- ants, *Mathematical models, Velocity, Diffu- n, Tidal effects, Currents (Water), Turbulence, rbulent flow.
ntifiers: Estuary flow.

e effects of the transverse variations of velocity dispersion in oscillatory estuary flow were in- stigated. The dispersion coefficient is found to pend on the tidal period and a characteristic time turbulent diffusion. Applying the relationship to me estuaries, it is concluded that the effects of e transverse variations of velocity may cause spersion to be as much as 10 times greater than it ould be if only the vertical variations were con- dered. However, for continuous injection condi- ns, this possible increase appears to cause calcu- ed concentrations to change by only 10% to %. (Knapp-USGS)
70-09217

DEPOSITION OF FINE-GRAINED SUSPENDED SEDIMENT FROM TIDAL CURRENTS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
I. N. McCave.
Journal of Geophysical Research, Vol 75, No 21, p 4151-4159, July 20, 1970. 9 p, 3 fig, 2 tab, 28 ref.

Descriptors: *Sedimentation, *Tidal waters, *Tidal effects, *Currents (Water), *Deposition (Sediments), Marine geology, Tides, Sedimentary structures, Sedimentation rates, Sediment transport.
Identifiers: Tidal currents.

Reliance on the commonly expressed assumption that fine-grained sediment is deposited from tidal systems only at slack tide is found to give rates of deposition much lower than those actually found in the German Bight. A model of quasi-continuous deposition is formulated with the assumption that the viscous sublayer of the turbulent boundary layer accepts sediment by settling but does not eject it back into the main flow. This model is only valid at low shear values (less than 1.2 cm/sec). Recent studies of the nature of the viscous sublayer have shown that it is periodically disrupted with fluid ejection as the result. There is a slight excess of ejection over input for sediment, and rates of deposition by the quasi-continuous model will be somewhat too high. Application of these models to mud layers in tidal deposited sands and in flaser bedding shows that these layers cannot be produced during slack tide. The time is too short and suspended sediment concentrations are too low. These layers must represent some periodicity other than that of tides, possibly that of storm and calm conditions. (Knapp-USGS)
W70-09232

A SUMMARY OF PRELIMINARY STUDIES OF SEDIMENTATION AND HYDROLOGY IN BOLINAS LAGOON, MARIN COUNTY, CALIFORNIA,
Geological Survey, Washington, D.C.
J. R. Ritter.
US Geological Survey Circular 627, 1970. 22 p, 5 fig, 1 tab, 19 ref.

Descriptors: *Sedimentation, *Sediment transport, *Bays, *Lagoons, *California, Currents (Water), Sediment transport, Littoral drift, Water circulation, Particle size, Sands, Provenance.
Identifiers: Bolinas Lagoon (Calif).

The U.S. Geological Survey is investigating sedimentary and hydrologic conditions in Bolinas Lagoon, a 1,100-acre lagoon 15 miles northwest of San Francisco. Two series of measurements of suspended-sediment load and water discharge in Bolinas Lagoon inlet showed that much of the suspended sediment is sand and that the average velocity was as much as 4.7 feet per second. Littoral drift near the inlet was generally toward the inlet, whereas farther from the inlet the pattern is irregular. Circulation velocities in the lagoon decrease rapidly away from the inlet, but probably remain high enough to erode bottom sediment along the channels. In most of the lagoon median size of bottom sediment was fine sand. Sediment was derived chiefly from Monterey Shale. (Knapp-USGS)
W70-09235

COASTAL WETLANDS OF VIRGINIA-INTERIM REPORT,
Virginia Inst of Marine Science, Gloucester Point.
Marvin L. Wass, and Thomas D. Wright.
Virginia Institute of Marine Science Special Report in Applied Marine Science and Ocean Engineering No 10, December 1969. 154 p, 19 fig, 6 tab, 81 ref, append.

Descriptors: *Wetlands, *Virginia, *Surveys, *Land management, *Conservation, Wildlife conservation, Water law, Zoning, Legislation, Economics, Land resources, Fishing, Natural resources, Preservation, Scenery, Recreation.
Identifiers: Virginia coastal wetlands.

Coastal wetlands occupy only 1% of the total area of Virginia, and marshes occupy 1/2%. Yet 95% of Virginia's annual harvest of fish (commercial and sport) from tidal waters is dependent to some degree on wetlands. Wetland productivity ranges from very little on some small salt barrens to about 10 tons per acre per year in the best grass marshes. Productivity on the tidal flats, which apparently cover more area than does marsh on the Eastern Shore seaside is probably at least one-fourth that in the marsh. Virginia has not adopted a legal definition of wetlands. Such a definition is needed before protective legislation can be enacted. Preliminary economic evaluation of wetland productivity indicates that an average acre of wetland generates primary tangible benefits of $78/year. These benefits largely accrue to the public rather than to the wetland owner. Present wetland use and management is determined by the owner and often does not constitute the most beneficial use of the land to the public. To insure continuing high yields, to enhance value, and to serve the best public interests, it is recommended that the State acquire or otherwise exercise some degree of control over the uses and alterations of wetlands. (Knapp-USGS)
W70-09350

POLLUTION OF ESTUARIES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05C.
W70-09383

ISOPACHOUS MAPPING OF THE LOWER PATUXENT ESTUARY SEDIMENTS BY CONTINUOUS SEISMIC PROFILING TECHNIQUES,
Naval Oceanographic Office, Washington, D.C. Coastal Oceanography Branch.
Newell T. Stiles, and Donald R. Wiesnet.
U S Naval Oceanographic Office Informal Report No IR 70-37, May 1970. 26 p, 11 fig, 1 tab, 21 ref.

Descriptors: *Profiles, *Bottom sediments, *Estuaries, *Sounding, Instrumentation, Mud, Sediments, Sedimentation, Channel morphology, Acoustics, Bathymetry, Surveys.
Identifiers: Patuxent Estuary.

The thickness and extent of the sediment cover in the Patuxent Estuary was determined using a high-frequency, high-spatial resolution, shallow-penetration, continuous seismic profiling system. The isopachous map provides the sub-bottom information required to determine optimum locations for placing test equipment on the river bottom. Mud filled depressions, acoustically transparent to 12-kHz sound pulses, occur mainly north of Half Pone Point, and east of the present river channel. Based on identification of first sub-bottom reflectors, these depressions are as much as 16 feet thick. The dominance of the thicker deposits east of the channel and evidence of a submerged terrace indicates that either the channel has migrated to the west, or that the channel of the Patuxent River at this location was larger in the past and has subsequently filled in much of the material on the eastern edge. Maximum penetration at the scarp of the submerged terrace was 36 feet beneath the water-sediment interface. (Knapp-USGS)
W70-09390

THE EFFECT OF SALINITY ON THE OXIDATION OF HYDROCARBONS IN ESTUARINE ENVIRONMENTS,
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W70-09424

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DISPOSAL OF BRINE BY SOLAR EVAPORATION: FIELD EXPERIMENTS,
New Mexico State Univ., University Park.
For primary bibliographic entry see Field 02D.
W70-09150

DESALTING COST CALCULATING PROCEDURES.
Southwest Research Inst., Houston, Tex.
W. L. Prehn, Jr., and J. L. McGaugh.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $1.25. US Office of Saline Water Research and Development Progress Report No 555, May 1970. 143 p, 50 fig, 2 tab, 74 ref, 8 append.

Descriptors: *Desalination plants, *Cost analysis, Cost comparisons, Construction costs, Maintenance costs, Operating costs, Water costs, Total costs, Water rates, Waste water disposal, Injection wells, Evaporation pans.
Identifiers: Desalination costs.

This report presents the results of a study and compilation of desalting cost calculating procedures by alternative desalting methods and related systems. The user may calculate, for cost comparison purposes, the capital costs and operating and maintenance costs for five desalting processes as a preliminary to a possible detailed engineering feasibility analysis. The five desalting processes are (1) electrodialysis (ED), (2) reverse osmosis (RO), (3) multistage flash distillation (MSF), (4) vapor compression-vertical tube evaporator-multistage flash distillation (VC-VTE-MSF), and (5) vacuum-freezing vapor-compression (VFVC). (Knapp-USGS)
W70-09241

MANUAL ON SOLAR DISTILLATION OF SALINE WATER.
Battelle Memorial Inst., Columbus, Ohio.
S. G. Talbert, J. A. Eibling, and G. O. G. Lof.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $2.00. US Office of Saline Water Research and Development Progress Report No 546, Apr 1970. 263 p, 152 fig, 23 tab, 529 ref. OSW Contract No 14-01-0001-1695.

Descriptors: *Solar distillation, *Desalination processes, *Distillation, *Desalination apparatus, *Solar stills, Dropwise condensation, Heat transfer, Solar radiation, Evaporation, Water supply, Water costs, Saline water, Economics.
Identifiers: Solar desalination.

This manual, prepared under the sponsorship of the U.S. Office of Saline Water, is a comprehensive treatise on the state of the art of solar distillation. Its primary purposes are to apprise water-supply planners of the potential of solar distillation and to assist them in designing practical plants. Information for the manual was assembled from an extensive review of the literature and from correspondence and discussions with solar-still designers from various countries. An attempt was made to classify the various designs into recognizable categories in which there are realistic data and to present the kind of information that will assist solar-still designers in making logical choices of [illegible] for their particular situations. Solar distillation of salt water appears well suited to the supply of potable water to small communities where the natural supply of fresh water is inadequate or of poor quality, and where sunshine is [illegible]. The distilled water cost is between $3 and $4 per 1000 gallons. These water costs are generally lower than those associated with other desalination equipment in plant sizes of up to perhaps 50,000 gpd. (See also W70-09243) (Knapp-USGS)
W70-09244

FINAL REPORT ON REVERSE OSMOSIS MEMBRANES CONTAINING GRAPHITIC OXIDE.
Westinghouse Electric Corp., Pittsburgh, Pa.
E. S. Bober, L. C. Flowers, P. K. Lee, and D. E. Sestrich
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. US Office of Saline Water Research and Development Progress Report No 544, May 1970. 116 p, 15 fig, 24 tab, 53 ref. OSW Contract No 14-01-0001-2154.

Descriptors: *Membranes, *Reverse osmosis, *Clay minerals, Semipermeable membranes, Permselective membranes, Laboratory tests, Bentonite, Membrane processes.
Identifiers: Graphitic oxide membranes.

Membranes formed from graphitic oxide (GO) and from bentonite clay were tested for reverse osmosis performance. GO membranes fabricated from a three year old batch of GO had essentially the same performance as those formed a year and a half earlier indicating that aging of the dispersions is not a problem. The mechanical strength of GO membranes was significantly improved by overcoating them with a layer of microcrystalline collagen (Avitene H) in coating weight ratios between 1 and 10 times the GO layer weight. Within this range of coating weight, no adverse effect was observed on the desalination performance of the GO. Use of collagen layers to sandwich the GO membrane, while further improving mechanical strength, adversely affected desalination performance. Standard six layer membranes exhibited salt rejection values of 94.2% and water flux of 0.55 gfd when used with 0.5% NaCl solution at feed pressures of 600 psi. A one layer membrane exhibited a salt rejection efficiency of 90.5% and a flux of 1.0 gfd. Usable ammonium bentonite membranes were fabricated by use of poly-anionic additives. All bentonite membranes, regardless of the polyvalent additive used, could achieve salt rejection efficiency values above 60%. (Knapp-USGS)
W70-09245

HYDROCASTING REVERSE OSMOSIS MEMBRANES.
Hydronautics, Inc., Laurel, Md.
R. Matz, M. P. Tulin, A. Gollan, H. S. Preiser, and H. Alcalay.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $1.25. US Office of Saline Water Research and Development Progress Report No 542, June 1970. 138 p, 34 fig, 16 tab, 17 ref, 3 append. OSW Contract No 14-01-0001-1727.

Descriptors: *Desalination apparatus, *Membranes, Desalination plants, Film, Membrane processes, Cellulose, Costs.
Identifiers: Membrane hydrocasting, Tubular membranes.

Hydrocasting provides a means for the in-situ formation of a tubular desalination membrane within a pre-assembled plant, flushing out the membrane as required, and regenerating fresh membrane surfaces, without dismantling the assembly and by techniques which may easily be automated. The support tube is filled with cellulose acetate casting solution prepared conventionally, and is forced through the system under pressure by means of an air or a gas column, thus forming an annular film of the solution on the wall of the support tube. Subsequently, the membrane may be heat-conditioned in-situ, by forcing hot water through the system for the required time. At no time should it be necessary to dismantle the plant for membrane replacement, and for plants of sufficiently large capacity, the membrane forming system could be an integral part of the plant. A desalting plant utilizing the hydrocasting process was conceived and subjected to an engineering and economic analysis. (Knapp-USGS)
W70-09246

A METHOD FOR THE EVALUATION OF THE SYSTEM AND COST EFFECTIVENESS OF LARGE SEA WATER DISTILLATION PLANTS,
Planning Research Corp., McLean, Va.
Albert Brown.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $1.00. US Office of Saline Water Research and Development Progress Report No 539, Mar 1970. 100 p, 10 fig, 12 tab, 14 ref, 3 append. OSW Contract No 14-01-0001-1453.

Descriptors: *Desalination plants, *Flash distillation, *Cost analysis, *Systems analysis, *Computer programs, Mathematical models, Value engineering, Design, Maintenance, Maintenance costs, Operations.
Identifiers: *Cost-effectiveness analysis.

A method was developed for prediction of average distillation plant-effectiveness for each year of plant life, and for analysis of cost-effectiveness of variations in design concept and in maintenance procedures. Using the total cost of a variation and the associated plant-effectiveness, the variation which will result in reduced product water cost can be singled out by cost-effectiveness analysis. An Effectiveness Model was developed as well as a method for cost-effectiveness analysis. The Effectiveness Model embodies equipment performance characteristics and process thermodynamics for determination of overall desalting plant system-effectiveness. Subsystem-effectiveness is treated using general probability distributions of time-to-failure and repair duration for components. The computer program which was developed treats parametrically, the specific distribution functions which adequately describe the failure and repair duration processes for the equipment under consideration. In order to demonstrate the methodology, the Effectiveness Model was used and cost-effectiveness analysis was performed on both the multistage-flash and combined-vertical-tube-flash processes and plant designs. (Knapp-USGS)
W70-09247

IMPROVEMENT OF TUBULAR CELLULOSE ACETATE MEMBRANES BY FEED ADDITIVES.
Philco-Ford Corp., Newport Beach, Calif.
Wayne J. Subcasky
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402. US Office of Saline Water Research and Development Progress Report No 532, June 1970. 96 p, 35 fig, 21 tab, 13 ref. OSW Contract No 14-01-0001-2201.

Descriptors: *Reverse osmosis, *Membrane processes, *Surfactants, Permselective membranes, Ion transport, Laboratory tests, Semipermeable membranes, Permeability.
Identifiers: Membrane improvement.

An investigation was made of the effectiveness of surface active agents as feed additives to improve membrane performance in terms of salt and urea rejection. Surfactant variables studied included charged and uncharged types, concentration, nature of the hydrophilic and hydrophobic groups, hydrophilic to hydrophobic ratio, molecular weight, and molecular arrangement of the hydrophilic and hydrophobic groups within the molecule. Poly (vinyl methyl ether) in the 50 to 100 ppm concentration range was an effective feed additive for improving the rejection of both NaCl and urea. For NaCl-containing feed solutions, improvements in salt reduction from 4 to 34% or in product flux from 8 to 18% were achieved. For a series of

oxyethylene-nonylphenols, additive effective- was found to depend markedly upon the rophilicity of the additive. A cationic surfactant he quaternary ammonium salt type gave im- ements in excess of 400% in salt reduction or rovements greater than 140% in product flux NaCl-containing feed solutions. A proposed el for feed additives is presented in which in- ction of the hydrophilic groups of the additive water decreases the ability of water to solvate dissolved species in the feed solution. (Knapp- S)
0-09248

ERVISION, CONSTRUCTION AND ALUATION OF A SEA WATER DESULFAT- PROCESS PILOT PLANT,
alytic, Inc., Philadelphia, Pa.
. Ennis, and Gideon Gelblum.
sale by the Superintendent of Documents, U S ernment Printing Office, Washington, DC 02 - Price $0.50. U S Office of Saline Water earch and Development Progress Report No , March 1970. 40 p, 4 plate, 3 tab, 7 ref. OSW tract No 14-01-0001-2123.

criptors: *Descaling, *Desalination plants, stillation, *Sea water, *Sulfates, Ion exchange, ne water, Gypsum, Calcium sulfate, Scaling, er chemistry, Resins.
ntifiers: Barium.

noval of sulfates should resolve most of the blems of high temperature scale formation in illation desalination plants. A pilot sea water ulfating plant consists of two sections: a ulfating ion exchange cycle and a desulfating duct recovery section. Raw sea water can be fed ctly into the desulfating reactors or can be first arbonated and then desulfated. Ion exchange n in barium form is conveyed from the enerated resin surge bin, and fed into the first ium Exchanger. Aided by agitation, the resin is tacted by the sea water. By controlling the ratio ea water to resin, a slight excess of barium ion is ntained in solution, causing precipitation of ium sulfate to take place in the sea water. The n is thus converted to the sodium form. The ex- sted resin recovered at the primary screen is ed with process water and rescreened by the ondary Screen to be separated from the rinse er. It is then conveyed to the barium loading eration. (Knapp-USGS)
0-09354

SIGN AND CONSTRUCTION SYSTEM FOR E DETERMINATION OF TRANSPORT AND MPACTION COEFFICIENTS OF REVERSE MOSIS MEMBRANES,
dronautics, Inc., Laurel, Md.
Matz, and R. E. Kohl.
r sale by the Superintendent of Documents, U S vernment Printing Office, Washington, DC 402 - Price $1.50. In: Hydrodynamic Aspects of salination by Reverse Osmosis, Part 1: U S Of- e of Saline Water Research and Development gress Report No 543, p 1-39, June 1970. 39 p, fig, 4 tab, 7 ref. OSW Contract No 14-01-0001- 05.

scriptors: *Desalination apparatus, *Reverse os- sis, *Permselective membranes, *Ion transport, aboratory tests, Permeability, Hydrodynamics, mosis, Semipermeable membranes.
ntifiers: Membrane hydrodynamics.

embrane transport coefficients are related to the enomenological coefficients which relate the w of water and solute through membranes under e influence of driving potentials across the mem- anes. At least three coefficients are required to aracterize membranes and these, derived from eoretical analyses, are assumed to be indepen- nt of fluxes and driving potentials. In the case of verse osmosis membranes, the three transport efficients are: the filtration coefficient, (L sub P) e reflection coefficient, and the solute permea- bility coefficient. The existence of compaction effects has been known for some time. A tentative analysis of the problem was made in which the effect was assumed to be confined to the porous backing. The effect of the reduction in void ratio which results is an increased resistance to flow and a decreased permeability to the diffusion of salt. A characterization or membrane-testing system designed using these considerations is described and shown diagrammatically. (See also W70-09357) (Knapp-USGS)
W70-09356

THE DETERMINATION OF THE TRANSPORT COEFFICIENTS OF CELLULOSE ACETATE MEMBRANES,
Hydronautics, Inc., Laurel, Md.
R. Matz, and C. Elata.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, DC 20402 - Price $1.50. In: Hydrodynamic Aspects of Desalination by Reverse Osmosis, Part 2: U S Office of Saline Water Research and Development. Progress Report No 543, p 40-93, June 1970. 54 p, 18 fig, 13 tab, 12 ref. OSW Contract No 14-01-001-1305.

Descriptors: *Desalination apparatus, *Reverse osmosis, *Membrane processes, *Hydraulics, *Ion transport, *Permeability, Osmosis, Permselective membranes, Semipermeable membranes, Hydrodynamics, Compaction.
Identifiers: *Membrane compaction, Membrane hydrodynamics.

Transport coefficients of anisotropic cellulose acetate membranes of the Loeb-Sourirajan type were determined by using two independent methods of the transport coefficients of the membranes and the subcoefficients for each of the two layers (dense and porous) of which they are composed. Values for the various coefficients are tabulated and related to membrane heat-treatment. Most of the membranes studied were made from a uniform and constant casting solution, and no other membrane systems were studied. Dense layer permeabilities are relatively constant for membranes of the same heat treatment, even after prolonged pressurization. The permeability of the dense layer is significantly pressure related in short period tests made after an initial-set period during which the major initial compaction of the porous layer occurs. Hydrostatic permeabilities are substantially larger than permeabilities measured by osmotic means. This can only be attributable to internal polarization at the dense-porous layer interface, and there is some evidence to confirm this conclusion. (See also W70-09358) (Knapp-USGS)
W70-09357

A COMPACTION THEORY FOR MODIFIED REVERSE OSMOSIS MEMBRANES,
Hydronautics Inc., Laurel, Md.
C. Elata.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, DC 20402 - Price $1.50. In: Hydrodynamic Aspects of Desalination by Reverse Osmosis, Part 3: U S Office of Saline Water Research and Development Progress Report No 543, p 94-111, June 1970. 18 p, 3 fig, 1 tab, 9 ref. OSW Contract 14-01-001-1305.

Descriptors: *Desalination apparatus, *Reverse Osmosis, *Membrane processes, *Permeability, *Permselective membranes, Hydraulics, Hydrodynamics, Ion transport, Semipermeable membranes, Diffusivity, Laboratory tests, Compaction.
Identifiers: *Membrane compaction.

Compaction of modified Reverse Osmosis membranes reduces the water permeability of modified membranes under pressure with time. While it was found that both the rejection and the salt diffusivity remain approximately constant with time, the water permeability may decrease significantly. Experimental evidence indicates that plastic deformation or creep occurs during compaction and bears the major responsibility. A general equation for the compaction effect was derived. The analysis leads to a complicated semiempirical expression which may be approximated by a simple log-log relationship. (See also W70-09359) (Knapp-USGS)
W70-09358

COMPACTION OF CELLULOSE ACETATE MEMBRANES,
Hydronautics, Inc., Laurel, Md.
R. Matz.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, DC 20402 - Price $1.50. In: Hydrodynamic Aspects of Desalination by Reverse Osmosis, Part 4: U S Office of Saline Water Research and Development. Progress Report No 543, p 112-157, June 1970. 46 p, 21 fig, 5 tab. OSW Contract No 14-01-0001-1305.

Descriptors: *Desalination apparatus, *Reverse osmosis, *Membrane processes, *Permeability, *Permselective membranes, Laboratory tests, Hydraulics, Hydrodynamics, Ion transport, Semipermeable membranes, Diffusivity, Compaction.
Identifiers: *Membrane compaction.

A model was established for reverse osmosis membrane compaction as a function of time, pressure, and membrane permeabilities, based on analogous flux of water through packed clay beds. Experimental runs with membranes under pressure show that anomalous flow conditions occur at the very beginning of the tests, and steady conditions are achieved after some time, varying from 10 mins. to over 3 hours. Thereafter, the flow behavior under constant pressure load is typical and reasonably reproducible for different membranes prepared under the same conditions. It is not unlikely that anomalous behavior can be attributed to flawed membranes. It seems likely that there is an initial compression of the membrane resulting in the expulsion of water from the porous part of the membrane, followed by a much slower recovery which is nevertheless accompanied by positive flow. The subsequent increase in flow rate could be attributable to a rapid initial compaction resulting in further expulsion of water from within the membrane porous layer before the final steady state compaction is achieved. Variations in membrane thickness with time were plotted and appear to confirm this, and that the bulk of the compaction occurs very shortly after the application of pressure. (See also W70-09356) (Knapp-USGS)
W70-09359

DISTILLATION DIGEST: VOLUMES 1 AND 2.
Office of Saline Water, Washington, D.C.

For sale by the Superintendent of Documents, U S Government Printing Office, Washington, DC 20402 - Price $2.50. U S Office of Saline Water Research and Development Progress Report No 538, March 1970. 353 p, 149 fig, 30 tab, 5 ref.

Descriptors: *Desalination processes, *Distillation, *Abstracts, *Research and development, Design, Engineering, Thermodynamics, Structural design, Laboratory tests, Pilot plants, Documentation, Model studies, Hydraulics, Heat transfer.
Identifiers: Office of Saline Water.

Summaries are presented of reports by research contractors to the Office of Saline Water on development of distillation methods of desalination. This is one of a continuing series of reports designed to present accounts of progress in saline water conversion and the economics of its application. Such data are expected to contribute to the long-range development of economical processes applicable to low-cost dimineralization of sea and other saline water. (Knapp-USGS)
W70-09360

WATER TECHNOLOGY,
Rice (Cyrus Wm.) and Co., Pittsburgh, Pa.
William E. Bell, Donald R. Brenneman, Ronald M. Burd, Robert E. Moore, and JamesK. Rice.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, DC 20402 - Price $1.25. U S Office of Saline Water Research and Development Progress Report No 536, March 1970. 156 p, 21 tab. OSW Contract No 14-01-0001-2139.

Descriptors: *Desalination processes, *Waste water treatment, *Desalination plants, *Reviews, *Technology, Engineering, Corrosion, Sealing, Design, Research and development, Brines, Saline water, Waste disposal, Water chemistry.
Identifiers: Desalination technology.

Saline and product water technology at the OSW Test Facilities at Freeport, Roswell, San Diego, Webster, and Wrightsville Beach are evaluated. Review and comments are presented on engineering reports, analytical methods, operational data sampling points and waterside problems such as seawater brine-formed deposits and product water corrosion. A detailed review is presented of chemical, physical, and instrumental techniques used in inorganic, organic, biological, and dissolved gas analyses applicable to desalination process environments. (Knapp-USGS)
W70-09361

DEVELOPMENT OF REVERSE OSMOSIS MEMBRANES,
Universal Water Corp., Del Mar, Calif.
S. Manjikian, S. Liu, M. Foley, C. Allen, and B. Fabrick.
Available for sale by Superintendent of Documents, U S Government Printing Office, Wash, DC 20402 - Price $1.00. U S Office Saline Water Research and Development Progress Report No 534, June 1970. 90 p, 19 fig, 20 tab, append. OSW Contract No 14-01-0001-2093.

Descriptors: *Membranes, *Reverse osmosis, *Cellulose, Desalination processes, Thin films, Permselective membranes, Semipermeable membranes, Laboratory tests, Membrane processes.
Identifiers: Cellulose acetate butyrate.

Ultraselective membranes having adequate flux were produced from cellulose acetate butyrate as a film base. Salt rejection of 99.8% at a flux of 8-10 gal/sq ft day was achieved treating feed water of 5000 ppm NaCl at 600 psig. Using sea water as feed and an operating pressure of 1000 psig, a 99.7% rejection of total dissolved solids was achieved at a flux of 5 gal/sq ft day. These operating characteristics were obtained without heat treating the membrane. Proper choice of solvents and additives is a critical factor in the preparation of cellulose acetate butyrate membranes. Best results have been obtained using acetone as the principal solvent and triethyl phosphate as a modifying solvent with a combination of glycerol and n-propanol as a flux promoting additive. (Knapp-USGS)
W70-09362

ENGINEERING AND ECONOMIC EVALUATION STUDY OF REVERSE OSMOSIS,
Kaiser Engineers, Oakland, Calif.
F. L. Harris, G. B. Humphreys, H. Isakari, and G. Reynolds.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, DC 20402 - Price $3.75. U S Office of Saline Water Research and Development Progress Report No 509, December 1969. 506 p, 66 fig, 92 tab, 61 ref, 7 append. OSW Contract No 14-01-0001-1669.

Descriptors: *Desalination, *Reverse osmosis, *Water costs, *Economics, *Value engineering, Optimization, Mathematical models, Systems analysis, Cost analysis, Hydraulics, Fluid mechanics, Computer programs, Cost-benefit analysis.
Identifiers: Reverse osmosis costs.

A parametric engineering and economic analysis of the reverse osmosis process was performed in which water costs were examined for demineralizing feedwaters with salinities of 2000, 3000 and 5000 ppm in plant sizes of 1, 10 and 50 mgd capacity, product water recoveries of 50, 60 and 80%, and operating pressures of 400, 600 and 800 psi. Capital and operating costs were prepared using state-of-the-art technology for tubular plate-and-frame, spiral wound, and hollow fine fiber reverse osmosis plant design concepts. Mathematical models were prepared to represent the hydrodynamic characteristics of each design concept. These models, in conjunction with computer codes were used to optimize plant design and operating parameters. Plant capital and operating costs were also prepared on the basis of anticipated improvements in reverse osmosis technology. (Knapp-USGS)
W70-09363

3B. Water Yield Improvement

AN ENERGY BUDGET STUDY ABOVE THE FOREST CANOPY AT MARMOT CREEK, ALBERTA, 1967,
Meteorological Service of Canada, Calgary (Alberta).
For primary bibliographic entry see Field 02D.
W70-09111

ENERGY RELATIONSHIPS IN THE DESIGN OF FLOATING COVERS FOR EVAPORATION REDUCTION,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 02D.
W70-09112

WATER USE BY SALT CEDAR,
Geological Survey, Lubbock, Tex.; and Texas Tech Univ., Lubbock.
For primary bibliographic entry see Field 02D.
W70-09113

EFFECTS OF FOREST CLEAR-FELLING ON THE STORM HYDROGRAPH,
Georgia Univ., Athens.
John D. Hewlett, and J. D. Helvey.
Water Resources Research, Vol 6, No 3, p 768-782, June 1970. 15 p, 7 fig, 2 tab, 10 ref.

Descriptors: *Storm runoff, *Rainfall-runoff relationships, *Floods, *Clear-cutting, *Forest management, Conservation, Forestry, Hydrograph analysis, Watershed management, Flood control, Land management, Soil conservation, Infiltration, Evapotranspiration.
Identifiers: Experimental watersheds.

Earlier speculation that evapotranspiration from forests and the consequent soil water deficits under forests are factors in the mitigation of flooding was verified by a paired watershed experiment. Mature hardwood forest on a 108-acre catchment in the southern Appalachians was clear-felled after an 18-year calibration period. No forest material was removed, and no overland flow (surface runoff) occurred. A statistical analysis of all major storm hydrographs before and after clearing revealed that after felling stormflow volume (quick flow) was significantly increased 11% overall, or 0.23 inch at the mean quick flow volume of 2.1 inches. Peak discharge increased slightly after felling (about 6 cfsm or 7% at the mean peak flow of 92 cfsm). Time to peak, recession time, and quick flow duration were tested to an accuracy within 10% of their mean values, but no treatment effect was detected. Quick flow increases due to felling ranged from 0 in small floods to 1.9 inches during a record 7-day flood sequence, a 22% increase over the total quick flow (8.7 inches) expected during that regional record flood. The effect of forest evapotranspiration on floodwater released by deep-soil slopes persists throughout the year, a result explainable the variable source area concept of runoff. (Knap USGS)
W70-09117

TRANSPIRATION OF PONDEROSA PINE AN DOUGLAS FIR AFTER TREATMENT WIT PHENYLMERCURIC ACETATE,
Arizona Univ., Tucson.
Kenneth N. Brooks, and David B. Thorud.
Water Resources Research, Vol 6, No 3, p 95 959, June 1970. 3 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Evapotranspiration control, *Tra piration control, *Water yield improveme *Forest management, Ponderosa pine tre Douglas fir trees, Chemcontrol.
Identifiers: Phenylmercuric acetate, Antitra pirants.

Phenylmercuric acetate (0.001 M) reduced tra piration of ponderosa pine and Douglas fir in greenhouse without increasing foliage tempe tures. The reductions were 48% and 24%, resp tively, and the effect lasted at least seven da Some foliage on one treated tree of each spec showed browning four weeks after treatment. (napp-USGS)
W70-09207

HYDROLOGICAL ANALYSIS OF VOLCAN TERRANE: LOWER BASIN OF THE R GRANDE DE SAN MIGUEL, EL SALVADOR,
Food and Agriculture Organization of the Unit Nations, Kingston (Jamaica).
David Wozab, and J. Roberto Jovel.
Bulletin International Association of Scienti Hydrology, Vol 15, No 2, p 47-66, June 1970. 20 7 fig, 6 tab.

Descriptors: *Hydrogeology, *Irrigation wat *Water supply, *Water balance, *Rainfall-runo relationships, Groundwater, Water levels, Wat yield, Rainfall, Infiltration, Recharge, Runoff, Ba flow, Igneous rocks, Aquifers.
Identifiers: *El Salvador.

Standard hydrological methods were used to eval ate the water resources of a volcanic area that co prises the Lower Basin of the Rio Grande de S Miguel, El Salvador. The lower San Miguel Bas consists of a faulted valley situated at the base o series of old and recent volcanoes bounding t valley on the East, a tuff block to the South, a consolidated volcanics (lahars) on the West a North. The valley fill consists of pyroclastics whi diminish in particle size with distance from the vo canoes in the southern portion; however, t pyroclastics may be interbedded with lake deposi A principal objective of the evaluation was to a sess the feasibility of irrigating 10,000 hectares the valley. Almost half of the annual precipitati infiltrates into the ground. Of this quantity, abo one third is accounted for by the existing hydrolog cal balance between recharge and depletion. T remainder moves from the valley to the San Migu River as groundwater runoff and, if retained, is su ficient in quantity to meet the full anticipated i rigation demand. (Knapp-USGS)
W70-09370

A PREDICTION EQUATION FOR VEGET TION EFFECTS ON WATER YIELD FRO WATERSHEDS IN ARID AREAS,
Utah State Univ., Logan. Dept. of Soils a Meteorology.
B. L. Grover, C. B. Campbell, and M. D. Campbel Soil Science Society of America Proceedings, V 34, No 4, p 669-673, July-August 1970. 5 p, 1 fig, tab, 23 ref.

Descriptors: *Runoff forecasting, *Water yiel *Arid lands, *Soil-water-plant relationships, *I tah, Small watersheds, Water supply, Water yie improvement, Watershed management, Fore management, Land management, Water conserv tion.

lentifiers: Water yield forecasting.

water yield prediction equation is based on plant ype, water use profiles, and historic precipitation ecords. The equation can be set at any desired robability value. Yields predicted for sites occu- ied by deep-rooted brush species average 14 cm ss per year than those for sites occupied by a rass-forb complex. This pattern holds for central tah watersheds higher than 2,330 m above mean ea level in 4 out of 5 years. (Knapp-USGS)
/70-09381

C. Use of Water of Impaired Quality

RY LANDS AND DESALTED WATER,
ak Ridge National Lab., Tenn.
ale Young.
ci, Vol 167, No 3917, p 339-343, Jan 1970. 5 p, 1 g, 5 tab, 31 ref.

escriptors: Desalination, *Demineralization, Sea ater, *Irrigation water, Irrigated land, Irrigation fficiency, Crops, Land reclamation, Costs, Arid nds, Deserts, Coasts, Water sources, Agriculture, Vater requirements, Graints (Crops), Water esources, Water costs, Bibliographies.
lentifiers: Irrigated agriculture, Dual-purpose uclear plants.

third of the world's land is dry and virtually unoc- upied, while half of the population is jammed into tenth of the land area. Mounting population pres- ure and the preference people seem to have for eserts indicate that the vast, warm dry areas of the orld would be attractive for human occupancy if ater and power needs were met. Since much arid nd lies near the sea, seawater desalination is a otential fresh water source when inexpensive al- ernate sources are not available. Cities and indus- ries can be developed along the ocean shore, ringing with them some agriculture for garden roduce. A more difficult question is the extent esalinated water can be used for irrigation in arid nds for producing staple foods. A preliminary tudy at Oak Ridge National Laboratory, Tenn, ealt with intensive year-round farming in deserts, ased on the use of distilled water in association ith clustering industries. Production costs for rice nd wheat are in the general area of recent grain rices, for water costs of around 35 to 20 cents per 000 gal, respectively. These water prices are ithin the estimated future cost range for desalted ater. Has 31 references. (USBR)
/70-09030

IGRATION OF SOLUBLE SALTS IN AN IR- IGATED FIELD IN RELATION TO RAINFALL ND IRRIGATION,
epartment of Agriculture, Lethbridge (Alberta). ater Resources Div.
. N. Graveland.
anadian Journal of Soil Science, Vol 50, No 1, p 3-45, Feb 1970. 2 fig, 3 ref.

escriptors: *Alkaline soils, *Salinity, *Soil water ovement, *Irrigation effects, *Rainfall, Irrigated nd, Irrigation programs, Irrigation practices, Ir- igation, Semiarid climates, Water table, Migra- ion, Soil moisture, Soil water, Saline soils, Salts, oil chemistry, Soil chemical properties, Precipita- ion (Atmospheric).
dentifiers: *Soluble salts, *Alberta (Canada), *Ir- igated agriculture.

An alkaline soil in a pasture near Vauxhall, Alberta Canada) was studied in an effort to determine the effects of rainfall and irrigation on salt migration. The soil was sampled once a week during the grow- ng season and then once every 10 days until Janua- ry. The fluctuating water table of the area was traced by reading an observation well in the center of the test plot at the time of each sampling. The amount of water applied in the 3 irrigations was recorded and a rainfall record was kept. Changes in the concentration of soluble salts were compared with water table levels, soil moisture content, and precipitation records. Soluble salt content varied over 100 percent during the growing season and was inversely related to moisture content. Caution is obviously required when sampling for salinity values during the growing season, because water application and evapotranspiration are then at a maximum. (Carr-Arizona)
W70-09140

SPACE HEATING IN URBAN ENVIRONMENTS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08C.
W70-09192

USES OF WASTE HEAT,
Oak Ridge National Lab., Tenn.
S. E. Beall.
This article draws upon six studies conducted by ORNL, some of which are sponsored by the U.S. Department of Housing and Urban Development. Oak Ridge National Laboratory Review, Spring 1970, p 9-14. 4 fig.

Descriptors: *Thermal powerplants, *Powerplants, *Energy losses, *Water conservation, *Air conditioning, *Heating, *Cooling, *Thermal power, *Multiple-purpose projects, *Water reuse, *Water supply, *Pollution abatement, *Water pollution control, *Water cooling, *Steam turbines, *Thermal pollution, Long tube vertical distillation, Evaporators, Aquatic algae, Horticultural crops, Poultry, Greenhouses, Fish farming, Irrigation water.
Identifiers: *Waste heat, *Uses of waste heat, *Central heating and cooling, *Space heating, *Farm uses of waste heat, Steam powered buses.

Presents new concepts for beneficial use of a large part of the heat discharged from the exhausts of turbines of fossil fuel or nuclear power plants. Both urban and rural sites offer opportunities for applying low temperature heat to useful purposes. Waste steam or hot water from power plants, between 300 deg F to 380 deg F, can be competitive with present urban space heating sources, even if the power plant is 10 miles from the heat distribution point. In most cities in the United States, more waste heat can be used for cooling, (in absorbtion systems) during the crucial summer period than is needed in the winter for residential and commercial heating. The average reduction in waste heat disposal that could be attained in this manner in urban areas is estimated to be 60 per cent. Other uses of the waste heat are discussed, including heating and cooling of greenhouses and poultry houses, and heating of aquaculture ponds. Evaporation of waste water and distillation of brackish or salt water for potable water supply or irrigation uses is considered feasible, but costly at present. Steam storage tanks to provide power for buses and switch engines are considered technically and economically feasible. The use of 104 deg F irrigation water is being studied in Oregon on several experimental farms. Similar studies are underway at Washington State University. A study of installations of underground pipes heated with condenser discharge water to stimulate growth of crops is underway at Oregon State University. (Poertner)
W70-09193

EXPERIMENT IN THE LEACHING OF SALINE LAND IN SOUTHERN KAZAKHSTAN,
Ya. D. Kalinin.
Translated from Hydraulic Engineering and Reclamation (Gidrotekhnika i melioratsiya), No 8, p 66-75, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 201-209, 1969. 9 p, 2 fig, 8 tab, 7 ref.

Descriptors: *Leaching, *Saline soils, *Land reclamation, *Irrigation, Drainage, Irrigation effects, Irrigation practices, Salinity, Salt balance, Soil management.
Identifiers: *USSR, *Kazakhstan.

Saline lands in Kazakhstan were leached for the first time over a large area (1100 hectares) at state farm No. 1, located in the area of the Arys'-Turkestan irrigation system (northwestern part of Chimkent Province). The site of this irrigation system is between the gently sloping piedmont plain of the Kara-Tau Ridge and the old alluvial plain of the Syr-Dar'ya River. The elevations of this area are 200-240 m and the slopes, 0.001-0.006. The mean annual precipitation is 184-210 mm with a weak maximum in the winter-spring period. The mean annual air temperature is 12-12.7 deg C. The frost-free period lasts 195 days with a mean daily temperature sum of 4300 deg C. The average annual relative air humidity is 53% and evaporative power reaches 1500 mm per year. Prior to leaching, a salt survey was performed. It was found that of the total area of the irrigated area, 38.6% was saline, including 29.8% with soil salinity ranging from 0.7 to 3.0%. The permissible residual salinity after leaching was found to be 0.3-0.4% with allowance for the composition of the initial salts. Leaching removed 145,000 metric tons of salts (69%), including 29,300 metric tons of the chloride ion (96%), from the upper meter of the soil, originally containing 211,000 metric tons of salt. (Knapp-USGS)
W70-09258

3D. Conservation in Domestic and Municipal Use

CITY OF NEW YORK V NEW YORK WATER SERVICE CORP (CITY MAY ORDER AN INCREASE IN WATER SUPPLY).

274 NY 100, 8 NE2d 294-296 (1937).

Descriptors: *Water supply, *New York, *Cities, *Municipal water, Water demand, Water shortage, Waterworks, Water requirements, Administration, Legislation, Jurisdiction, Local governments, Planning, Water delivery, Water costs, Utilities, Administrative agencies, Judicial decisions, State governments, Remedies, Adjudication procedure, Legal aspects.
Identifiers: Mandamus.

Over a period of several years plaintiff city repeatedly directed defendant water supplier to install additional water mains so that a greater supply of water could be provided to a certain area of the city. Defendant failed to comply. Plaintiff applied to the court for a peremptory order of mandamus compelling the defendant to install the additional mains. The court held for plaintiff, stating that the state public service laws gave the city water commissioner authority to provide for an increase in water supplies. Mandamus was a proper remedy to require adherence to the order, and, in a serious situation such as a shortage of water no hearing was required before issuance of the order. (Hubener-Florida)
W70-09025

3E. Conservation in Industry

IN-PLANT WASTE REDUCTION,
Humble Oil and Refining Co., Baytown, Tex.
For primary bibliographic entry see Field 05D.
W70-09316

FLEXIBILITY KEY TO DESIGN OF MACHINING PLANT'S TREATMENT FACILITIES,
Chrysler Corp., Detroit, Mich.
For primary bibliographic entry see Field 05D.
W70-09326

A TEST OF FEDERAL WATER PROJECT EVALUATION PROCEDURES WITH EMPHASIS ON REGIONAL INCOME AND ENVIRON-

MENTAL QUALITY: DETROIT RIVER, TRENTON NAVIGATION CHANNEL,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
A. Allan Schmid, and William Ward.
Agricultural Economics Report No. 158, April 1970. 73 p, 10 tab, 3 plates, 1 append. Water Resources Council Agreement WRC69-6.

Descriptors: *Navigation, Industrial water, Leontief models, Cost-benefit analysis, Income analysis, Construction costs, Cost sharing decision making, Federal project policy, Federal budgets, Environmental effects.
Identifiers: *Water Resources Council Task Force Report, McLouth Steel Company, Detroit region, Lake Erie, Michigan Department of Conservation, US Army Corps of Engineers.

This report is an effort to apply the principles set forth by a Special Task Force of the U.S. Water Resources Council in their June 1969 report, Procedures for Evaluation of Water and Related Land Resource Projects. The Task Force encouraged potential effects to local incomes and to the environment from proposed water projects. In this study the proposed extension by the Army Corps of Engineers of the Trenton Channel which leads into the Detroit River in Michigan was examined. This project would enlarge the commercial navigational use of the channel and would thereby allow the McLouth Steel Company to develop a primary steel mill at Gibraltar, Michigan. The authors sought to determine how the actual costs and benefits of this project could be best predicted. Although their results were not conclusive, they stressed the need to study alternative locations and to view the proposed project in relation to the needs of other regions in the United States for navigational and industrial development. (Holmes-Rutgers)
W70-09497

3F. Conservation in Agriculture

REDUCTION OF SEEPAGE LOSSES FROM IRRIGATION CANALS AS A RESULT OF SILTING,
Research Inst. for Water Resources Development, Budapest (Hungary).
F. Papfalvy, O. Starosolszky, and Z. Szigyarto.
13TH Congr Int Assn Hydraul Res, Proc Vol 4, p 299-309, Aug-Sept, 1969. 11 p, 7 fig, 5 ref.

Descriptors: *Seepage losses, Canals, *Irrigation canals, Observation wells, *Silting, *Permeability, Sealants, *Reduction, Boreholes, *Canal seepage, Seepage, Foreign research, Foreign design practices.
Identifiers: Hungary.

The irrigation canals built about 1960 in eastern Hungary are practically impervious up to a certain degree of fullness. Above the normal operating waterlevel, a sudden increase in seepage losses occurs, but decreases rapidly if the higher level is maintained for extended periods. Impermeability of the lower part of the canal cross section is caused by settling sediment, as demonstrated by soil mechanics tests and hydraulic investigations. The sealing effect of silting becomes observable in 1 to 2 yr. Silting as a stochastic process variable in time and space is described numerically in terms of soil type. (USBR)
W70-09043

HYDRAULIC DESIGN FOR CHECK METHOD OF IRRIGATION,
Punjab Agricultural Univ., Hissar (India).
V. V. N. Murty.
Journal of Agricultural Engineering Research, Vol 14, No 4, p 319-322, Dec 1969. 4 ref.

Descriptors: *Hydraulic design, *Irrigation design, *Flood irrigation, *Water loss, *Deep percolation, Soil water movement, Soil water, Soil moisture, Percolation, Irrigation water, Flow, Soils, Surface irrigation, Irrigation systems, Irrigation practices, Irrigation.
Identifiers: *Check irrigation.

The check method of irrigation, which consists of irrigating rectangular plots surrounded by levees, has not been as thoroughly studied as the border strip or the furrow methods. The check method is, nonetheless, widely used. An expression is derived to help determine the size of the check for given stream size and soil conditions and to estimate deep percolation losses under the given conditions. Losses depend on the time necessary to initially cover the entire plot with water and when required time decreases, losses decrease. The procedure for designing the check method of irrigation is illustrated with an example. (Carr-Arizona)
W70-09136

THE EFFECT OF SOIL MOISTURE LEVEL OF THE INCIDENCE OF EARLY BLIGHT ON POTATO AND TOMATO PLANTS,
National and Univ. Inst. of Agriculture, Rehovoth (Israel). Volcani Inst. of Agriculture Research.
For primary bibliographic entry see Field 02I.
W70-09137

EFFECT OF SOIL PROFILE TYPE AND FERTILIZER ON MOISTURE USE BY WHEAT GROWN ON FALLOW OR STUBBLE LAND,
Saskatchewan Univ., Saskatoon. Dept. of Soil Science.
E. de Jong, and D. A. Rennie.
Canadian Journal of Soil Science, Vol 49, No 2, p 189-197, June 1969. 1 fig, 7 tab, 13 ref.

Descriptors: *Wheat, *Water utilization, *Slopes, *Fallowing, *Stubble mulching, Soil profiles, Crop production, Crop response, Soil moisture, Soil water, Water management (Applied), Fertilization, Semiarid climates, Great Plains, Soil-water-plant relationships, Precipitation (Atmospheric).
Identifiers: *Saskatchewan (Canada), *Slope position, *Water-use efficiency.

The effect on water utilization of fallowing, fertilizer use, and slope position was studied for wheat grown on the Canadian Prairies in the years 1960-1967. Yield, water consumption, and water-use efficiency of wheat grown on fallow land or stubble mulch varied according to whether the crop grew in a depression, on a lower slope, upper slope, or knoll. Although there were few significant differences between slope positions, yield and water-use efficiency showed a tendency to increase down the slope. Data also showed that, in general, yields increased linearly with water use. (Equations describing yield as a function of moisture use are illustrated.) Second-degree polynomials represented more realistic yield functions, but did not greatly increase the correlations. Growth of yield per cm of water used increased with fertilization and was greater on fallow than on stubble land. Mean yields for unfertilized stubble and fallow wheat were 1,340 and 1,500 kg/ha, respectively. For fertilized stubble and fallow wheat the figures were 1,720 and 1,860 kg/ha, respectively. (Carr-Arizona)
W70-09139

ON USING A TIME VARIABLE INFILTRATION WITH THE ISRAELSON BORDER IRRIGATION EQUATION,
Saskatchewan Univ., Saskatoon. Dept. of Agricultural Engineering.
D. I. Norum.
Journal of Agricultural Engineering Research, Vol 14, No 2, p 173-175, June 1969. 3 fig, 5 ref.

Descriptors: *Equations, *Border irrigation, *Flow rates, *Infiltration, *Water flow, Flow, Time, Irrigation systems, Surface irrigation, Irrigation.
Identifiers: *Israelson border irrigation equation, *Rate of infiltration.

The author demonstrates why an equation for a time variable infiltration rate (I=ct superscript - 1/2) cannot be used in combination with the Israelson differential equation for flow down an irrigation border (qdt=Ixdt+hdx). When using specific values of c and h, such a method greatly overestimates distance x for given time t. Also, c is overestimated when working from field data to arrive at c and h. An exact solution to the infiltration-advance problem is presented. (Carr-Arizona)
W70-09141

DIGESTED SLUDGE DISPOSAL ON CROP LAND,
Illinois Univ., Urbana; and Metropolitan Sanitary District of Greater Chicago, Ill.
For primary bibliographic entry see Field 05D.
W70-09328

FORAGE CROP IRRIGATION WITH OXIDATION POND EFFLUENT,
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 05D.
W70-09423

COLORADO V KANSAS (APPORTIONMENT OF WATER BETWEEN UPRIVER AND DOWNRIVER STATES).
For primary bibliographic entry see Field 06E.
W70-09460

NEBRASKA V WYOMING (APPORTIONMENT OF INTERSTATE WATERS UNDER PRIOR APPROPRIATION).
For primary bibliographic entry see Field 06E.
W70-09461

BURLEY IRRIGATION DIST V ICKES (RIGHTS TO PROFIT FROM DAM OPERATION).

116 F2d 529-542 (DC Cir 1940).

Descriptors: *Idaho, *United States, *Irrigation districts, *Power operation and maintenance, Hydroelectric plants, Dams, Electric power production, Multiple-purpose projects, Irrigation, Governments, Irrigation operation and maintenance, Pumping plants, Economics, Prior appropriation, Irrigation programs, Water utilization, Water requirements, Operating costs, Power system operation, Net profit, Cost-benefit ratio, Judicial decisions, Legal aspects, Electric power demand, Federal reclamation law.

Plaintiff irrigation district and another district operated a dam for irrigation purposes with a secondary function of selling left-over power for commercial purposes. The United States owned the dam and had decreed that profits from the operation were to be distributed according to the proportionate usage of the water by plaintiff and the other district. Due to great seasonal variations in the amount of water used for irrigation, a continuous supply of power for commercial use could not be maintained, so defendant Secretary of the Interior contracted with a private power company for the needed extra power supply and sought to distribute part of the net profit to the private power company. Plaintiff sought to enjoin defendant from so distributing such profits. Plaintiff argued that this was an interference with its rights to part of the profit. The United States Court of Appeals for the District of Columbia ruled that the profits to be distributed did not stem directly from operation of the dam by plaintiff and that such contract with the private company was necessary to preserve the primary function of irrigation for which plaintiff's dam was designed. The court held that it was within defendant's discretion to allocate a portion of the profits to the power company. (Barker-Florida)
W70-09472

LBION-IDAHO LAND CO V NAF IRRIGA-ION CO (PRORATION OF WATER RIGHTS NDER PRIOR APPROPRIATION DOCTRINE).
or primary bibliographic entry see Field 06E.
70-09474

NITED STATES EX REL SIERRA LAND AND ATER CO V ICKES (GOVERNMENT RANTS OF RIGHTS-OF-WAY OVER PUBLIC ANDS FOR IRRIGATION SYSTEMS).
4 F2d 228-232 (DC Cir 1936).

escriptors: *Irrigation systems, *Water rights, Right-of-way, *Public lands, Appropriation, Irgation, Irrigation programs, Irrigation waters, Irgation canals, Irrigation ditches, Canals, Conuits, Ditches, Water sources, Water requirements, Vater utilization, Water conveyance, Judicial decions, Legislation, Federal government, Public ghts, Federal project policy, Administrative agenes.

ursuant to an act of Congress authorizing issuance f rights-of-way to canal and ditch companies over ublic lands for purposes of constructing canals nd ditches for irrigation, plaintiff water company ought a writ of mandamus to compel the Secretary f the Interior to approve its application for such ghts-of-way. The Secretary, pursuant to Departent of the Interior regulations, had refused plainff's applications because of its failure to establish ny right to the use of waters essential to the operaon of the proposed irrigation system. The court eld that the granting of rights-of-way over public nds for maintenance of ditches and canals for irigation purposes was within the delegated authoriy of the Department of the Interior, but that the ight to appropriate natural sources of water supply as determinative under state law. Thus a prior etermination by the California supreme court that laintiff had no right to the use of the waters relied pon for the operation of the proposed irrigation ystem justified the Secretary of the Interior in lenying plaintiff's application for rights-of-way. The writ of mandamus was denied. (Snow-Florida)
W70-09480

PADDY RATOONS,
nstitute of Agricultural Research, Addis Ababa (Ethiopia).
C. R. K. Prashar.
World Crops, Vol 22, No 3, p 145-147, May/June 1970. 9 tab, 2 fig, 3 ref.

Descriptors: *Crop response, Water utilization, Meteorological data, Water levels, Crop production.
Identifiers: *Paddy ratoons, (IR-8, IR-5), Institute of Agricultural Research, Melka Werer, Ethiopia.

This article provides data which demonstrates that growth of two varieties of rice (IR-8, IR-5) as paddy ratoons produces greater yields and uses less amounts of water than growth of rice as a main crop (first crop). The author tested various heights for ratooning and various dates for the first watering. Since the paddy ratoon matures in a shorter period of time than the main crop, it therefore uses less total water allowing for economy in irrigation. The author also points out that paddy ratooning offers the farmer labor saving advantages and at the same time can increase his rice yields considerably. (Holmes-Rutgers)
W70-09501

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

RESERVOIR LEAKAGE IN LIMESTONE TERRAINS,
Berlen C. Moneymaker.
Bull Assn Eng Geol, Vol 6, No 1, p 3-30, Spring 1969. 28 p, 6 fig, 5 ref.

Descriptors: Reservoir construction, *Reservoir leakage, *Reservoirs, *Reservoir sites, Seepage, Limestone, *Damsites, *Dam foundations, Grout curtains, *Engineering geology, Leakage, Grouting, Cutoff walls, Foundation rocks, Underseepage, Dams, History, Dam construction.
Identifiers: Reservoir modifications, Seepage control, Cavernous rock, *Solution channels, Hales Bar Dam, Tenn, Great Falls Dam, Tenn.

Constructing watertight reservoirs in limestone terrain may be difficult and costly. Limestone may contain solution cavities, joints, bedding planes, and other open structures that serve as leakage paths. Solution channels may occur along reservoir rims and below streambeds to depths of hundred of feet. Most reservoirs selected after adequate exploration can be made sufficiently watertight by proper foundation preparation and treatment and by rim-tightening programs. Experiences with leaking reservoirs of the TVA are reviewed. Hales Bar and Great Falls reservoirs in Tennessee developed leaks immediately after impoundment. In both instances, leakage began along solution cavities and accelerated rapidly as flowing water under hydrostatic head removed clay, silt, or sand from filled or partially filled cavities. Leakage from Hales Bar Reservoir occurred through subriver cavities beneath the dam. At Great Falls, leakage was through the rim along tubular cavities developed on bedding planes. The leakage control programs at Hales Bar and Great Falls are described. (USBR)
W70-09042

PREDICTIONS OF RESERVOIR LEAKAGE,
Dames and Moore, San Francisco, Calif.
For primary bibliographic entry see Field 02F.
W70-09046

LEAKAGE THROUGH BURIED CHANNELS,
Howard A. Coombs.
Bull Assn Eng Geol, Vol 6, No 1, p 45-52, Spring 1969. 8 p, 5 fig.

Descriptors: *Reservoir leakage, *Leakage, Underground, Glaciers, Glacial deposits, Damsites, Channels, Freezing, Frozen ground, Rivers, Engineering geology, Glacial drift, Valleys, Geologic formations, Clays, Dams, Grout curtains, Drainage basins, Impervious blankets, Rockfill dams, Washington.
Identifiers: *Underground cavities, Glacial till, Sultan Dam No 1, Wash, Tolt River Dam, Wash, Buried channels (Geology).

Continental glaciers moved southward several times during the Pleistocene in the Puget Sound area of western Washington. At the same general time, alpine glaciers moving westward down the Cascade Range encountered the continental glaciers. The result was widespread disruption, diversion, and burial of previous drainage channels. These ancient buried drainage channels, existing along present riverbeds, can be the cause of reservoir leakage as dams are constructed. The Tolt River Dam, 30 mi east of Seattle, is in an entrenched river with andesite flows forming the bottom and glacial drift forming the sides of the valley. Leakage through the permeable glacial material in the old channel was sealed by an impervious blanket. At the Sultan Dam, 35 mi northeast of Seattle, the buried channel was filled with till forming an effective seal against leakage. Gorge Dam on the Skagit River presented a leakage problem only during construction. To prevent water from the old reservoir (400 ft upstream) from moving into the new deep excavation, a frozen subsurface seal 220 ft high was installed. Thorough exploration and imaginative methods of treatment of these buried channels may permit construction of many additional dams and reservoirs for future use. (USBR)
W70-09049

RESEARCH INTO THREE-DIMENSIONAL SEEPAGE IN JOINTED ROCK FOUNDATIONS OF HIGH DAMS.

13th Congr Int Assn Hydraul Res, Proc Vol 4, p 151-158, Aug-Sept 1969. 8 p, 6 fig, 14 ref.

Descriptors: Anisotropy, *Seepage, *Flow nets, *Underseepage, Models, *Dam foundations, *Model studies, Three-dimensional, Rock foundations, Flow characteristics, Percolation, Foreign research, Two-dimensional, Soil mechanics, *Electric analogs, Analog models.
Identifiers: Seepage control, USSR.

Theoretical justification and recommendations on methods of modeling using electrical analogy are presented for 3-dimensional percolation in an anisotropic medium. Specific reference is made to seepage through dam foundations. A procedure is suggested whereby 2-dimensional plan and elevation models constructed from electroconductive paper are used to determine an approximate grouting and drainage scheme and a 3-dimensional model is used for refining the approximate scheme. Model studies made for a dam are described and results presented. Problems of seepage in anisotropic media can be reduced to problems of seepage in isotropic media by distorting dimensions of individual model zones and by separate construction and mounting of models of rock masses having differently oriented joints. (USBR)
W70-09050

CROSBY V DE LAND SPECIAL DRAINAGE DIST (VALUE TO FARMLAND OF IMPROVED DRAINAGE SYSTEM).

367 Ill 462, 11 NE2d 937-942 (1937).

Descriptors: *Illinois, *Drainage districts, *Assessments, *Direct benefits, Tiles, Drainage systems, Ditches, Surface waters, Drains, Property values, Land appraisal, Market value, Productivity, Drainage water, Local governments, Tile drainage, Surface runoff, Judicial decisions, Taxes, Farms, Land tenure, Benefits, Estimated benefits, Adjudication procedure, Legal aspects.

Defendants, commissioners of a drainage district, planned to improve open drains in the district and made assessments against those lands which would receive benefits from the improvements. Plaintiffs, owners of assessed lands, claimed the assessments greatly exceeded the benefits which would accrue to their lands. The lower court heard conflicting testimony as to the need for the drainage improvement, its effects on the farmland, and its value to the land. The jury found for plaintiffs, returning a lower assessment on each tract of land. The Illinois supreme court affirmed, stating that the jury's finding was not against the weight of the evidence. The court stated that if the jury believed from a preponderance of the evidence that the assessments exceeded the benefits, it had a duty to lower the assessments. In considering the value of the improvements to the land it was proper for the jury to consider only the direct benefits of the improved drain and not a general rise in value of the property. (Hubener-Florida)
W70-09051

DALY V STATE (FLOOD DAMAGES CAUSED BY CANAL CONSTRUCTION).
42 NE2d 14-15 (NY 1942).

Descriptors: *New York, *Flood damage, *Alteration of flow, *New York State Barge Canal canals, Construction, Crops, Streamflow, Natural flow, Floods, Canal design, Inland waterways, Navigation, Operation and maintenance, Judicial decisions, Legal aspects, Damages, Streams, Overflow, Watercourses (Legal).
Identifiers: *Lake Champlain.

Plaintiffs brought action against the State of New York for damages resulting from the flooding of their land. The land in question was situated on either side of Wood Creek, a stream which before 1908 flowed northerly and discharged into Lake Champlain. In 1908, the State, in constructing the Champlain branch of the Barge Canal through the Wood Creek Valley, substantially altered the flow of Wood Creek. Plaintiffs claim that these changes in the flow of the creek and the subsequent maintenance of the canal caused the flooding of their land and the destruction of their crops. The Court of Claims awarded money damages for this flooding and crop destruction. The Court of Appeals affirmed, per curiam. (Dearing-Florida)
W70-09143

COMM'RS OF DRAINAGE DISTRICT NO 5 V ARNOLD (JUDICIAL INTERPRETATION OF DRAINAGE STATUTE).

383 Ill 498, 50 NE2d 825-830 (1943).

Descriptors: *Illinois, *Administrative decisions, *Legislation, *Drainage districts, Boundaries (Property), Judicial decisions, Jurisdiction, Legal aspects, Natural flow doctrine, Proprietary power, State governments, State jurisdiction, Drainage ditches, Drainage systems, Drainage engineering, Administrative agencies, Adjudication procedure.

Defendant connected tile drainage ditches running across his land with an open ditch constructed by plaintiff drainage district. Defendant's land was located outside the district. An Illinois statute stated that any person whose land lay outside a drainage district and, in the opinion of the district commissioners, benefitted from work done in said district, would be deemed to have voluntarily applied to be included in said drainage district and to be subject to all provisions of the statute. The Supreme Court of Illinois held that the statutory language placed jurisdiction of such matters solely in the hands of the commissioners of the districts. Consequently, plaintiff commissioners' decision that defendant benefitted from work done in its drainage district, and thus came within the purview of the statute, was not judicially reviewable. The lower court proceedings were therefore a nullity. (Clarke-Florida)
W70-09154

THE OPTIMIZATION OF STORM-HOLDING TANKS: A PROBLEM OF WATER POLLUTION CONTROL,
Stanford Univ., Calif.
For primary bibliographic entry see Field 05G.
W70-09181

FLOOD PLAIN INFORMATION, COTTONWOOD CREEK, GUTHRIE, OKLAHOMA.
Corps of Engineers, Tulsa, Okla.

U S Army Corps of Engineers Flood Plain Report, May 1970. 31 p, 8 fig, 13 plate, 9 tab.

Descriptors: *Floods, *Flood damage, *Oklahoma, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Guthrie (Oklahoma), Standard project flood, Intermediate regional flood.

Flooding of Cottonwood Creek, Guthrie, Oklahoma is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09220

FLOOD PLAIN INFORMATION, SANTA CLARA RIVER, VENTURA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

U S Army Corps of Engineers Flood Plain Report, March 1970. 39 p, 19 fig, 11 plate, 4 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Ventura County (Calif), Santa Clara River (Calif), Standard project flood, Intermediate regional flood.

Flooding of the Santa Clara River, Ventura County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09221

FLOOD PLAIN INFORMATION, METROPOLITAN ATLANTA GEORGIA, UTOY CREEK, NORTH AND SOUTH UTOY CREEKS.
Corps of Engineers, Mobile, Ala.

U S Army Corps of Engineers of Flood Plain Report, June 1970. 38 p, 4 fig, 20 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Georgia, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: *Atlanta (Georgia), Standard project flood, Intermediate regional flood.

Flooding of Utoy Creek, Atlanta, Georgia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09222

DRAIN INSTALLATION FOR NITRATE REDUCTION,
Agricultural Research Service, Brawley, Calif. Southwestern Irrigation Field Station; Soil Conservation Service, Fresno, Calif.; and Bureau of Reclamation, Sacramento, Calif. Land Resources Branch.
For primary bibliographic entry see Field 05G.
W70-09228

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER AND FIVEMILE CREEK, ALLEGANY, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.

US Army Corps of Engineers Flood Plain Report, October 1969. 43 p, 7 fig, 10 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *New York, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Allegany (NY), Standard project flood, Intermediate regional flood.

Flooding of the Allegheny River, Allegany, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09252

PREPARATORY REPORT OF THE TECHNICAL SUBCOMMITTEE ON SNOW.
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 02C.
W70-09351

FLOOD DAMAGE PREVENTION.
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 10.
W70-09364

FLOOD PLAIN INFORMATION, COYOTE CREEK, SAN FRANCISCO BAY TO ANDERSON RESERVOIR, SANTA CLARA COUNTY, CALIFORNIA.
Corps of Engineers, San Francisco, Calif.

U S Army Corps of Engineers Flood Plain Report, February 1970. 26 p, 8 fig, 45 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *California, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Santa Clara County (Calif), Standard project flood, Intermediate regional flood.

Flooding of Coyote Creek, Santa Clara County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combination of these approaches. (Knapp-USGS)
W70-09365

A NOTE ON THE ESTIMATION OF THE PARAMETERS IN LOGARITHMIC STAGE-DISCHARGE RELATIONSHIPS WITH ESTIMATES OF THEIR ERROR,
For primary bibliographic entry see Field 02E.
W70-09374

SMALL RESERVOIRS AND PONDS OF THE CENTRAL CHERNOZEM PROVINCES, RSFSR,
Leningrad State Univ. (USSR). Limnology Lab.
G. V. Lopatin.
Translated from Russian. In: Water Balance and Silting of Small Reservoirs in the Central Chernozem of the Russian Soviet Federal Socialist Republic; Collection of Papers Translated for U S Agricultural Research Service, p 3-26, 1967. 24 p, 2 tab, 21 ref.

Descriptors: *Reservoirs, *Ponds, *Chernozems, *Reservoir construction, Water supply, Irrigation, Water utilization, Lakes, Rivers, Water source, Rain, Snow, Vegetable crops, Discharge (Water), Forests, Reservoir design.
Identifiers: *USSR, Chernozem Provinces.

This article is a general study of small reservoirs and ponds of the Chernozem region of the USSR

ith an emphasis on their utilization and efficient esign. The study includes: classification of reser- oirs; effectiveness of utilization of small reservoirs nd ponds in the national economy; (irrigation, vestock production); present status of small reser- oirs and ponds in the steppe and forest-steppe ones; and defects in planning, construction main- nance, repair, and operation of these water odies. (See also W70-09312). (Gabriel-USGS)
70-09415

LECTRONIC COMPUTER PROGRAM FOR YDRAULIC ANALYSIS OF BOX CULVERTS PR PROGRAM HY-3),
ureau of Public Roads, Washington, D.C.
or primary bibliographic entry see Field 08A.
70-09445

TUDY OF EROSION IN ROADSIDE RAINAGE CHANNELS IN NORTH AROLINA,
orth Carolina State Univ., Raleigh. School of En- neering.
lichael Amein, and H L Chu.
vailable from NTIS as PB-191 397, $3.00 in aper copy, $0.65 in microfiche. North Carolina tudy Report ERD-110-68-4, Apr 70. 55p

escriptors: *Drainage, *Road construction, itches, *Runoff, *Open channel flow.
lentifiers: *Roadside drainage.

n extensive field study of the performance of oadside drainage channels in North Carolina gainst the action of erosive forces was conducted nder this research. From the results of these field bservations and measurements, a criteria for the esign of stable roadside channels was developed. he report presents three methods of determining hether a triangular shaped roadside drainage hannel will be stable if it is fully grassed, partially rassed or bare earth when the discharge to be car- ed, the slope of the channel bottom, the side slope f the channel, and the soil characteristics of the hannel are known. (BPR)
70-09455

IOHAWK CARPET MILLS, INC V STATE FLOODING CAUSED BY STATE'S EGLIGENCE IN CANAL CONSTRUCTION).

67 App Div 707, 48 NYS2d 96-99 (1944).

Descriptors: *New York, *Ice jams, *Flood amage, *Channel improvement, Canals, Ice, Ice- vater interfaces, Boulders, Ice loads, Legal aspects, udicial decisions, Riparian land, Riparian rights, iparian waters, Watercourses (Legal), Damages, verflow, Flooding, Floodwater, Water spreading, Vater injury, Dredging, Explosives.

laintiff carpet mill brought action against defen- ant state seeking to recover for damages caused y a flood and ice jam in the Mohawk River and arge canal. Defendant had converted the river nto a barge canal and in so doing had altered the hannel by widening it, thereby creating spoil accu- nulation. An ice jam had backed up to plaintiff's roperty, and, when the river rose following up- tream rain, the ice and flood water came onto the roperty, crushing a wall of the mill and doing ther serious injury. Plaintiff argued that the state hould have taken action, such as dynamiting the am, in order to protect waterfront property. De- endant claimed that such jams had always freed hemselves and that no action had appeared neces- ary to protect the property. The court held that damages are allowable to those suffering injury caused by the use or management of the state's canals, or by the neglect or misconduct of any of- icer of the state having charge thereof. The order of the lower court dismissing plaintiff's claim was reversed, and a new trial was ordered to determine the amount of damages. (Price-Florida)
W70-09458

UNITED STATES V DICKINSON (GOVERNMENT'S LIABILITY FOR EROSION CAUSED BY FLOODING).
331 US 745, 67 S Ct 1382-1386 (1947).

Descriptors: *West Virginia, *Condemnation, *Compensation, *Condemnation value, Overflow, Land reclamation, Judicial decisions, Legal aspects, Dams, Damages, Impounded waters, Impoundments, Navigable waters, Riparian land, Riparian waters, Eminent domain, Flooding, Flood damage, Easements, Evaluation, Erosion control, Bank erosion, Federal government, United States, Erosion.
Identifiers: *Consequential damages.

Separate suits were brought by plaintiff landowners against defendant United States to recover the value of property taken by flooding and erosion caused by defendant's dam. The suits were consolidated for trial. Defendant contended that the actions were barred by the six year statute of limitations, but if the actions were deemed to have been timely brought, that the compensation awarded by the trial court for erosion was improper, as such erosion was merely consequential damage and not compensable. The court held that the taking which was the basis for the suits was not complete six years prior to the institution of said suits, and therefore such actions were not barred. The court stated that when the government takes property by flooding, it takes that property as well as that which inevitably washes away as a result of that flooding. If such erosion is in fact preventable by prudent measures, the cost of that prevention is a proper basis for determining damages. When plaintiffs' lands were taken, an obligation to pay for them then arose, and the fact that plaintiffs were permitted to reclaim portions thereof was irrelevant as to the creation of such obligation. The trial court's judgments for plaintiffs were affirmed. (Price-Florida)
W70-09462

UNITED STATES V WILLIS (LIABILITY FOR FLOOD DAMAGE).

141 F2d 314-317 (4th Cir 1944).

Descriptors: *West Virginia, *Compensation, *Condemnation value, *Condemnation, Eminent domain, Federal government, Judicial decisions, Legal aspects, Riparian land, Value, Property values, Appraisals, Evaluation, Damages, Rivers and Harbors Act, Flooding, Flood control, Dams, Dam construction, Navigable rivers, High water mark, Federal jurisdiction, Erosion control, Flood damage.

Plaintiff brought action to recover for flood damage which resulted from a dam constructed by defendant United States. Plaintiff was awarded damages in the trial court pursuant to the Rivers and Harbors Act of 1930. Defendant contended on appeal that the evaluation by the trial court of the land taken was improper, and that plaintiff was not entitled to an award for the loss of cribbing which was submerged when the new water level was established. The court, in affirming, held that the evidence supported the lower court's decision relating to the value of the property taken, and that the cribbing was plaintiff's property and he should be compensated for the loss thereof. The court stated further that the holding did not conflict in any way with previous decisions which held that consequential damages suffered in the exercise of the federal power to improve navigable streams are not recoverable. (Price-Florida)
W70-09464

UNITED STATES V WAUNA TOLL BRIDGE CO (OBSTRUCTION OF NAVIGABLE RIVERS).
130 F2d 855-857 (9th Cir 1942).

Descriptors: *United States, *Condemnation, *Bridges, *Navigable rivers, Appropriation, Administrative decisions, Community development, Easements, Eminent domain, Federal government, Federal jurisdiction, Judicial decisions, Legal aspects, Proprietary power, Public benefits, Relative rights, Right-of-way, Watercourses (Legal), Damages, Navigable waters, Riparian rights, Compensation.

Defendant was granted the privilege of constructing a private bridge over the Columbia River by an act of Congress. Shortly after its completion, Congress authorized the construction of a federal dam two miles below it. Despite a congressional act requiring, at the expense of the owner, alteration of a bridge which at any time obstructs navigation, Congress authorized reimbursement of all bridge owners on the river for required alterations resulting from the higher level of the impounded waters. In addition to this amount, defendant received from plaintiff United States the proceeds of a condemnation proceeding for a flowage easement allowing plaintiff to back up water over the easement and 2 piers supporting defendant's bridge. Defendant, however, claimed further damages in the form of lost tolls, ferry expenses and increased maintenance expenses. The court held that, pursuant to the above mentioned acts, defendant had an absolute duty to bear all expenses related to removing its obstruction to navigation. The reimbursement and condemnation awards were thus discretionary, and defendant could not be heard to complain of the lesser, incidental expenses. (Clarke-Florida)
W70-09466

PETERSON V UNITED STATES (PUBLIC WORK INCLUDES FLOOD CONTROL AND IMPROVEMENTS TO NAVIATION).
119 F2d 145-148 (6th Cir 1941).

Descriptors: *Federal government, *Projects, *Railroad relocation, *Claim (Contracts), Federal jurisdiction, Public benefit, Flooding, Flood control, Flood protection, Water management (Applied), Watershed management, Multiple-purpose projects, Administration, Economics, Management, Navigation, Project purposes, Project planning, Construction, Legal aspects, Judicial decisions, Legislation, Government supports, Supply contracts, Railroads.
Identifiers: *Public work.

Pursuant to the implementation of a flood control and navigation improvement project by a conservancy district and the federal government, it was necessary to relocate certain railroad tracks in order to prevent their being flooded. Therefore, the federal government entered into a formal contract with defendent contractor for the construction of the new railroad roadbed. In addition, defendant executed a bond with defendant surety pursuant to a federal statute requiring bond by any person who contracted with the United States for the performance of public work. A subcontractor of defendant contractor subsequently defaulted in payments for services and supplies, and, as result, plaintiff United States instituted a suit on the bond. Defendants denied all liability on the bond, claiming the work to be done under the contract was not public work, but benefited a privately owned railroad. The court stated that flood control and improvements to navigation involved public work within the meaning of the federal statute requiring bond because the public at large benefited from such work, even though private advantages could incidently be promoted. Therefore, the court held the bond was a valid and enforceable obligation. (Finman-Florida)
W70-09471

GOODMAN V UNITED STATES (FEDERAL GOVERNMENT'S LIABILITY FOR FLOOD DAMAGE).

113 F2d 914-919 (8th Cir 1940).

Descriptors: *Flood damage, *Flooding, *Dikes, *Obstruction to flow, Damages, Engineering structures, Alluvium, Rivers, Navigable rivers, Naviga-

tion, Judicial decisions, Channels, Federal government, United States, Condemnation, Eminent domain, Alluvial channels, Floods, Barriers, Diversion, Water levels, Compensation.
Identifiers: *Governmental immunity.

Plaintiff brought action against defendant United States to recover for flood damage to his crops and land, contending that defendant, in constructing dikes to improve navigation, had diverted the flow of the river adjacent to his alluvial land in such a manner as to cause the natural level of intermittent flood waters to be raised artificially, thus causing his land to be flooded. Defendant contended that plaintiff could not maintain his action because such action sounded in tort, and the federal government was immune from tort actions. The court held that plaintiff had failed to show that the damages constituted a taking of property within the meaning of the fifth amendment so as to require compensation. Plaintiff had to show that there was permanent, as opposed to temporary, damage in order to be able to maintain a suit against the government. Since there was no such showing, the instant action did sound in tort, and defendant was immune to it. (Snow-Florida)
W70-09473

INLAND POWER AND LIGHT CO V GRIEGER (FLOOD DAMAGE FROM NEGLIGENT DAM OPERATION).

91 F2d 811-819 (9th Cir 1937).

Descriptors: *Washington, *Flood damage, *Dams, *Reservoir operation, Floods, Flooding, Flood control, *Erosion, Reservoirs, Historic flood, Floodgates, Discharge (Water), Impounded waters, Water levels, Rainfall, Precipitation intensity, Excessive precipitation, Supercritical flow, Velocity, Flow rates, Average flow, Judicial decisions, Legal aspects, Flow augmentation.

Plaintiff riparian landowner brought action against defendant power company for damages which resulted from defendant's allegedly negligent operation of its dam, which was located upstream from plaintiff's property. Plaintiff argued that during unusually heavy rain, defendant discharged such amounts of water that its reservoir that valuable soil was eroded from his property and sand and gravel were deposited in its place. Defendant claimed that the damage caused to plaintiff's land was the result of an 'act of God', and that it had acted reasonably in discharging the excess water into the river. The Ninth Circuit Court of Appeals, in affirming the trial court's judgment for plaintiff, ruled that where damage results from defendant's negligence and an 'act of God' as concurring causes, defendant is liable to the same extent as though the damage has been caused by his negligence alone. (Barker-Florida)
W70-09476

UNITED STATES V CHICAGE B AND Q RR (EXTENT OF JUST COMPENSATION IN CONDEMNATION PROCEEDING).
82 F2d 131-141 (8th Cir 1936).

Descriptors: *Condemnation value, *Eminent domain, *Floodways, *Easements, Dams, Flooding, Design flood, Structures, Floods, Judicial decisions, Rivers, Mississippi River, Banks, Navigable rivers, Navigation, River flow, Federal government, Railroads, United States, Flood damage, Compensation, Condemnation, Legal asepcts, Right-of-way, Damages, Backwater.

The United States brought a condemnation suit for a flowage easement over lands flooded by a dam constructed in the interest of navigation. The condemned lands constituted an embankment supporting defendant's railroad tracks. Defendant contended that it was entitled to the value of lands actually flooded plus damages resulting to the remainder of the land as a result of the effects of saturation, wave action and distortion of ice which would harm the tracks and necessitate expensive repairs. Plaintiff admitted that defendant was entitled to the value of the land actually flooded, but contended that no responsibility existed as to the damages to the unflooded land. The court held that the meaning of 'taken', which required compensation under the fifth amendment, had been expanded to mean 'taken or damaged'. Thus where a portion of land is taken, just compensation includes all direct damages which arise out of such appropriation, including damages to the remainder of the property. Consequently, defendant was entitled to the value of the land flooded and to the damages which were a direct result from such flooding. (Snow-Florida)
W70-09482

CITY OF PHILADELPHIA V STANDARD OIL CO (USE OF PUBLIC BULKHEAD BY RIPARIAN OWNER).
79 F2d 764-767 (3rd Cir 1935).

Descriptors: *Bulkheads, *Pennsylvania, *Channel improvement, *Sediment control, Engineering structures, Structures, Walls, Retaining walls, Navigation, Docks, Judicial decisions, Dredging, Legal aspects, Bulkhead line, Rivers, Banks, Riparian rights, Riparian land, Navigable waters, Navigable rivers, Channels, Channel flow, Bank stability, Legislation, Relative rights.

Plaintiff municipality constructed bulkheads along the banks of a navigable river pursuant to legislative authorization. The act provided that riparian owners who made use of the bulkheads for wharf purposes were under a duty to pay to the municipality the cost of the bulkhead to the extent used. Plaintiff brought action against defendant oil company to recover the cost of a portion of the bulkhead, contending that defendant, in dredging a ship basin in front of the bulkhead, had used the bulkhead as an aid in preventing the river's banks from sloughing into the basin so as to be under a duty to pay the city for so using the bulkhead. Defendant contended that the act did not apply where the bulkhead was utilized as an aid to dredging operations. The court held that the act imposed upon riparian owners a duty to pay for the bulkhead only when it was used for wharf purposes, and that the activity of defendant was not of such purpose. Consequently, defendant was under no duty to pay the city for the cost of the bulkhead. (Snow-Florida)
W70-09483

COOPER V CITY OF BOGALUSA (FEDERAL RESPONSIBILITY FOR DAMAGES CAUSED BY NAVIGATION IMPROVEMENTS).
195 La 1097, 198 So 510-513 (1940).

Descriptors: *Louisiana, *Federal government, *Dredging, *Access routes, Navigable waters, Local governments, Legal aspects, Judicial decisions, Damages, Condemnation, Right-of-way, Channel improvement, Canal construction, Navigation, Compensation, Eminent domain, Legislation, Dams, Locks, Cost sharing.

Plaintiff landowner, whose land allegedly was isolated and access to it cut off by action of the United States in dredging a navigable river, sued defendant city for damages. Plaintiff contended that the city was liable since: (1) the United States was acting as agent of the city; (2) the city had provided the land for the government to build dams and locks on; and (3) the city had agreed to assume responsibility for all property damage incident to such construction. The court held that plaintiff had no cause of action against the city. The United States was not acting as agent of the city so as to render the city liable as a principal where the river improvement was for navigation purposes exclusively under the federal commerce powers and where the work was solely under government control. The city's responsibility for damages extended only to those damages which might be assessed against the United States. (Hubener-Florida)
W70-09486

SCOTT V RED RIVER-BAYOU PIERRE LEVEE AND DRAINAGE DIST (RIGHT TO COMPENSATION FOR EXPROPRIATED LAND).
7 So 2d 429-433 (La Ct App 1942).

Descriptors: *Louisiana, *Drainage districts, *Drainage systems, *Eminent domain, Canals, Damages, Compensation, Drains, Local governments, Legal aspects, Judicial decisions, Property value, Bridges, Assessments, Appraisals, Costs, Flood damage, Land tenure, Right-of-way, Construction.

Plaintiff landowner brought action against defendant drainage district for damages caused to her land when the district undertook the widening and deepening of a natural drain located on her property. Plaintiff sought recovery for: (1) land covered by spoil dirt extending 100 feet from the edge of the canal; (2) land damaged by overflowing drainage water; and (3) defendant's failure to construct a bridge over the canal. The court granted recovery only for the land actually used, i.e. that portion covered by the spoil dirt. The court held that plaintiff failed to state a cause of action with respect to the land damaged by overflow because she had not alleged either that the land had been assessed the previous year or the amount of the assessment. The failure to construct the bridge was not compensable since such a structure did not come within the constitutional provision requiring the drainage district to pay for 'property used or destroyed.' (Hubener-Florida)
W70-09487

MEYERING LAND CO V SPENCER (DRAINAGE DISTRICT HAS NO POWER TO CONSTRUCT SEWERS UNDER AUTHORITY FOR DRAIN CONSTRUCTION).
273 Mich 703, 263 NW 777-780 (1935).

Descriptors: *Michigan, *Drainage districts, *Sewers, *Administrative decisions, Drains, Pipes, Pipelines, Concrete pipes, Local governments, Adjudication procedure, Judicial decisions, Legal aspects, Decision making, Drainage programs, Economic impact, Water law, Surface drainage, Drainage systems, Septic tanks, Sewage disposal, Closed conduits, Sewage, Taxes, Assessments, Remedies.

Plaintiff landowners sued defendant drain commissioner to set aside and declare fraudulent certain proceedings laying out and establishing a drainage district, and to enjoin the collection of related tax assessments. Plaintiffs claimed that the drains were not laid out for the drainage of surface water, but as sewage facilities for certain subdivisions. Defendant contended that the proceedings were not subject to judicial review and could only be attacked through certiorari. The evidence established that the 'drains' followed the streets of the subdivisions, included a six-inch Y for every lot and were laid with sealed, watertight joints which prevented any surface drainage and that the natural drainage of the property was more than adequate. Reversing a judgment for defendant, the court held that defendant had no power to construct a sewer system in pursuance of a petition proceeding for a drainage system, and defendant's action was reviewable since it was outside his authority, although certiorari is the only remedy where the claim is that the authority was improperly exercised. (Liptak-Florida)
W70-09488

MAFFEI V BERRIEN COUNTY (COUNTY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT MAINTENANCE OF DRAINAGE SYSTEM).
293 Mich 92, 291 NW 234-236 (1940).

Descriptors: *Michigan, *Local governments, *Drainage practices, *Flood damage, Drainage, Surface drainage, Ditches, Drainage effects, Governments, Floods, Damages, Drainage water, Cities, Legal aspects, Judicial decisions, Water law, Excavation, Overflow, Streams, Surface runoff, Dredging, Channel improvement, Outlets.

laintiff farmer brought an action against defendant county for damages caused by flooding. The reek which flowed through plaintiff's farm was the rainage outlet for the natural and artificial drains unning through neighboring land. The county rain commissioner cleaned, deepened, and idened these drains to increase their drainage apacity, but did not perform any work on the outet creek. As a result the creek overflowed, amaged plaintiff's land and crops. Plaintiff conended that this was negligence, and that defendant ad a duty to protect landowners from such amage. Defendant contended that it was not liable or the negligent acts of its officers or agents in the bsence of statutory provision. The court held that, s a general rule, counties and municipalities are ot liable for the actions of their officers and agents ince they are involuntary corporations created by he state and in the state's behalf. The court held hat the duties imposed by law upon the county rain commissioner were not defendant's duties, herefore the negligent acts of the commissioner ere not the acts of defendant. Defendant's motion o dismiss was granted. (Liptak-Florida)
V70-09492

MILLER V MONONA COUNTY (DRAINAGE DISTRICT LIABILITY FOR NUISANCE).
294 NW 308-311 (Iowa 1940).

Descriptors: *Iowa, *Drainage districts, *Drainage, *Floods, Judicial decisions, Legislation, Administration, Drains, Flooding, Flood damage, Legal aspects, Drainage systems, Washouts, Rainfall, Dikes, Diversion, Diversion structures, Levees, Local governments.
Identifiers: *Nuisance.

Defendant was a drainage district whose facilities were claimed by plaintiff landowners to constitute a nuisance by increasing damage caused by floodwaters. The trial court ordered the district to abate the complained of nuisance. The Supreme Court of Iowa reversed, stating that drainage districts are creatures of statute and are incapable of creating nuisances when operating within the ambit of their constitutional authority. Nuisance statutes do not apply to properly operated drainage districts. The trial court in the instant case was without authority to order alteration of the structures of the drainage district on the ground that the structures constituted a nuisance. (Dye-Florida)
W70-09493

HOGUE V WONONA-HARRISON DRAINAGE DIST (PROTECTION OF PRIVATE PROPERTY FROM FLOODING CAUSED BY DRAINAGE IMPROVEMENTS).

296 NW 204-209 (Iowa 1941).

Descriptors: *Iowa, *Drainage districts, *Dikes, *Flooding, Judicial decisions, Legislation, Legal aspects, Missouri River, Taxes, Structures, Flood control, Flood protection, Levees, Surface drainage, Drainage effects, Drainage programs, Surface waters, Drainage, Floods, Floodgates, Drainage systems, Alteration of flow, Obstruction to flow, Surface runoff, Flood damage.

Plaintiff held upland property partly within defendant drainage district. Prior to action by the drainage district, plaintiff's land was sufficiently drained by a creek which emptied into a nearby river. After construction by the district of dikes along the river below plaintiff's property, floodwaters were backed up, damaging plaintiff's property. Plaintiff sought to require the drainage district to construct floodgates or other means of protecting his property from floodwaters. Defendant alleged that it was without statutory power to construct floodgates to protect plaintiff's land, part of which was outside the district. Furthermore, the construction of the dikes was within the proper exercise of powers of the district. The trial court ordered the district to protect plaintiff's land either by raising the level of dikes bordering the creek to the level of the dikes along the river or by providing floodgates. The Supreme Court of Iowa affirmed. Floodgates are part of a drainage system, and a drainage district is empowered to build them. A drainage district is empowered and obligated to protect lands flooded as a result of its activities. (Dye-Florida)
W70-09494

TOWN OF WAUSAUKEE V LAUERMAN (LIABILITY FOR FLOOD DAMAGES).
240 Wis 320, 3 NW2d 362-366 (1942).

Descriptors: *Wisconsin, *Dams, *Flood damage, Judicial decisions, Legal aspects, Legislation, Flooding, Floods, Bridges, Washouts, Recreation, Reservoirs, Damages, Risks, Rainfall, Rain, Governments, Local governments, Highways, Storms, Dam failure, Remedies, Excessive precipitation, Rivers.

Defendant landowner constructed a dam on a river which flowed through his property for the creation of a recreational pond. The dam broke following a heavy rainfall and damaged plaintiff town's property downstream. Plaintiff charged: (1) that defendant was liable under a statute imposing strict liability for damages caused by interference with the natural course of a stream; or (2) that defendant was negligent in maintaining the dam. Defendant denied that strict liability applied and contended that the rainfall was too heavy to foresee. The Supreme Court of Wisconsin held that the statute relied upon by plaintiff imposes strict liability for damages caused by the mere existence of a properly operated dam. Other damages are to be judged on the basis of negligence. Defendant was negligent only if the volume of rain and the consequent damage was foreseeable. The jury found the rainfall to be unusual for the area and not foreseeable by a reasonable and prudent man. Since foreseeability is a fact question, the jury's finding for defendant was upheld. (Dye-Florida)
W70-09495

ROCKFORD PAPER MILLS, INC V CITY OF ROCKFORD (FLOOD DAMAGE TO DAM AND OTHER PROPERTY FROM NEGLIGENT DAM OPERATION).
311 Mich 100, 18 NW2d 379-382 (1945).

Descriptors: *Michigan, *Dams, *Cities, *Impounded waters, Flow control, Rain, Ice, Judicial decisions, Legal aspects, Damages, Municipal water, Flood damage, Islands, Floodgates, Flooding, Dam failure, Excessive precipitation, Riparian rights, Diversion, Rivers, Public utilities, Water works, Water supply, Flow augmentation.

Plaintiff paper company owned a mill, land and a dam downstream from defendant city's dam. As a result of the melting of a heavy winter snowfall and an unusually heavy rainfall, the flow of the river upon which the dams were situated was significantly increased. The increased flow necessitated defendant's opening of its floodgates to maintain a normal water level behind its dam. As a result of the increased river flow, plaintiff's dam was damaged. Plaintiff brought action to recover these damages which it alleged resulted from defendant's negligent operation of its dam. The court held that defendant had a right to discharge water from its pond faster than it flowed in so as to reduce the elevation of the pond and facilitate its business. To hold defendant responsible there must have been a finding of negligence or an intention to release impounded waters to damage plaintiff's dam. No such finding had been made, and defendant could not be held responsible for a superfluity of waters coming from a flood condition arising above its dam. (Barnett-Florida)
W70-09496

4B. Groundwater Management

ELECTROLYTIC MODEL STUDY FOR COLLECTOR WELLS UNDER RIVER BEDS,
New Mexico Inst. of Mining and Technology, Socorro.
For primary bibliographic entry see Field 02F.
W70-09210

COMMON ERRORS IN DEVELOPING A GROUNDWATER AQUIFER,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 02F.
W70-09225

HYDROLOGICAL ANALYSIS OF VOLCANIC TERRANE: LOWER BASIN OF THE RIO GRANDE DE SAN MIGUEL, EL SALVADOR,
Food and Agriculture Organization of the United Nations, Kingston (Jamaica).
For primary bibliographic entry see Field 03B.
W70-09370

GROUNDWATER RECORDS OF SOUTH CAROLINA - 1966,
Geological Survey, Columbia, S.C.
For primary bibliographic entry see Field 02F.
W70-09411

4C. Effects on Water of Man's Non-Water Activities

WATER AS AN URBAN RESOURCE AND NUISANCE,
Geological Survey, Washington, D.C.
Harold E. Thomas, and William J. Schneider.
Available free on application to the US Geological Survey, Wash, DC, 20242. US Geological Survey Circular 601-D, p D1-D9, 1970. 9 p, 15 ref.

Descriptors: *Water resources, *Floods, *Urbanization, Water supply, Flood control, Rainfall-runoff relationships, Social aspects, Cities, Legal aspects, Water rights, Water law, Water resources development.
Identifiers: Urban hydrology.

Many urban activities are concerned with development and use of the land and its resources other than water; these activities affect the natural water flow system and are affected by it. The development and use of water may create nuisances if they adversely affect the use of the land and solid-earth resources and invade recognized property rights. Conversely, the development and use of the land resources may have effects on water that interfere with the rights of others and thus cause nuisances. In urbanized areas, water as a resource becomes increasingly inadequate to meet the requirements of the concentrated population and industry; it must be imported from other areas. Buildings and pavements inhibit groundwater recharge and promote rapid runoff from storms. Increased flood peaks cause erosion and sediment transport, as do various construction activities. Vulnerability to floods is increased by urban encroachment upon floodplains. In these and many other ways water causes inconvenience or annoyance to urban life and damage to property and thus constitutes a nuisance. The urban water problem can be solved, but only if a complete understanding of the role of water in the urban environment--and indeed in the overall water picture--is realized. Such understanding can be achieved through the proper interpretation of adequate date. (Knapp-USGS)
W70-09129

NEW YORK METROPOLITAN REGION--A MAJOR SEDIMENT SOURCE,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 02J.
W70-09203

FLOOD PLAIN MANAGEMENT - IOWA'S EXPERIENCE.
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 06F.
W70-09253

EVALUATION PROCESSES IN WATER RESOURCES PLANNING.
American Water Resources Association, Urbana, Ill.
For primary bibliographic entry see Field 06B.
W70-09369

4D. Watershed Protection

MORPHOLOGY OF GULLIES IN THE COLORADO ROCKY MOUNTAINS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Burchard H. Heede.
French resume. Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 79-89, June 1970. 11 p, 2 fig, 3 tab, 9 ref.

Descriptors: *Gullies, *Gully erosion, *Geomorphology, Erosion control, Colorado , Rocky Mountain Region, Sediment yield, Vegetation effects, Drainage patterns (Geologic).
Identifiers: Stream orders.

A classification of gullies into discontinuous and continuous channels not only expresses differences in channel morphology and stage of development, but also presents helpful criteria for design of gully control. The term 'critical location' was introduced for those locations within gullies that are obviously susceptible to changes, and whose direction of change is suggested. Regression analyses underlined the fact that the gullies constituted channels of youthful stage if relations between components in channel geometry were considered. (Knapp-USGS)
W70-09372

WATER EROSION, THE FORMING OF SEDIMENT FLOW OF SMALL STREAMS IN THE CENTRAL CHERNOZEM PROVINCES AND MEASURES FOR PROTECTING RESERVOIRS FROM SILTING,
For primary bibliographic entry see Field 02J.
W70-09414

PAYNE V MISSOURI VALLEY DRAINAGE DIST NO 1 (CONSTRUCTION OF NEW SETTLING BASIN AS REPAIR OF OLD BASIN).

272 NW 618-624 (Iowa 1937).

Descriptors: *Iowa, *Drainage districts, *Repairing, *Settling basins, Ditches, Drainage, Drainage effects, Drainage practice, Flood routing, Tile drainage, Sediments, Silts, Channel improvement, Drainage systems, Sediment control, Administrative decisions, Judicial decisions, Water law, Legal aspects, Right-of-way, Condemnation, Administration, Relocation, Assessments.

Plaintiff landowner brought action to enjoin defendant drainage district's construction of a new settling basin which would divert water from the old basin through a drainage ditch on plaintiff's land. Plaintiff alleged that silt and sediment from the old basin would fill up the ditch, rendering his tiled drainage system worthless. Plaintiff further contended that this new drainage plan required statutory notice and reclassification of the land. Defendant contended that, since the old basin was completely filled with silt and sediment, it was merely making repairs, for which no notice or reclassification was required. Affirming the dismissal of plaintiff's petition, the court held that the construction was obviously repair work since it was done solely to keep the drainage system functioning, the old basin being filled with silt and sediment. Therefore, no notice or reclassification was required. (Liptak-Florida)
W70-09490

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

A STUDY OF THE HYDROCHEMICAL FACIES OF THE WILCOX AQUIFERS IN MISSISSIPPI,
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 02K.
W70-09095

ANALYSIS OF LAG PHASE BOD CURVES USING THE MONOD EQUATIONS,
Heinz B. Braun, and Paul M. Berthouex.
Water Resources Research, Vol 6, No 3, p 838-844, June 1970. 7 p, 8 fig, 1 tab, 13 ref.

Descriptors: *Biochemical oxygen demand, *Mathematical models, Mathematical studies, Oxygen demand, Oxygen sag, Water quality, Water pollution effects, Biodegradation, Nutrients.
Identifiers: *Monod equations, Reaction rates.

The Monod biokinetic relations are used to develop a 3-parameter model to describe the biochemical oxidation of waste water substrates as observed in biochemical oxygen demand (BOD) tests, including those tests with an initial lag phase. A criterion relating the biological parameters of the model to the occurrence of a lag phase is presented. The model was applied to several sets of data that reflect a variety of conditions. Some statistical problems involving parameter correlation were noted. (Knapp-USGS)
W70-09122

RESERVOIR EFFECT ON DOWNSTREAM WATER TEMPERATURES IN THE UPPER DELAWARE RIVER BASIN,
Delaware River Basin Commission, Trenton, N.J.
Owen G. Williams.
US Geological Survey Prof. Paper 600-B, p B195-B199. 5 fig, 1 tab, 1 ref.

Descriptors: *Water temperature, *Delaware River, *Reservoirs, Hydrographs, Mass-curves, Climatic data, Mathematical models, Watersheds (Basins), River flow, Air temperature, Hypolimnion.
Identifiers: Thermographs.

Seasonal water-temperature data were obtained at five sites in the upper reaches of the Delaware River. The data were graphically analyzed by plotting and double-mass curves. Hydrographs, temperature records, and double-mass curves can be used to determine and substantiate both climatological and release effects on downstream water temperatures. Comparison of water-temperature records not affected by the reservoir releases with those collected on a stream which is affected, combined with a knowledge of local climatological conditions, can be used to estimate the effect of these releases on stream temperatures. Releases from New York City's Cannonsville Reservoir have caused a drop in water temperature of 26F, 8.1 miles downstream, and of 8F, 44.3 miles downstream. Releases from New York City's Pepactor Reservoir have caused a drop of 20F, 31 miles downstream, and 5F, 59.4 miles downstream. (Osborne-Vanderbilt).
W70-09171

A KINETIC AND EQUILIBRIUM STUDY OF THE ADSORPTION OF THE ORGANIC INSECTICIDES CARBARYL AND PARATHION UPON SOME SOIL ORGANIC MATTER SURFACES,
Purdue Univ., Lafayette, Ind.
J. A. Leenheer.
Purdue University, Doctor of Philosophy Thesis, August, 1970. p 110, 28 fig, 3 tab, 71 ref. OWRR Project A-005-IND (14).

Descriptors: *Pesticide kinetics, Pesticide adsorption, Carbamate pesticides, *Organic pesticides, Organic matter, Isotherms, *Soil organic matter, Surface adsorption.
Identifiers: Romney silty clay loam, Zanesville silty clay loam, Carlisle muck, Parathion pesticide.

Pesticides are a potential water pollutant. Soil organic matter surfaces adsorbs certain kinds of compounds and render them essentially immobile. The mechanism of pesticide adsorption on soil organic matter is reported in this study. The adsorptive capacities of Carbaryl and parathion upon various organic matter adsorbents were compared by determining adsorption isotherms for aqueous insecticide concentrations ranging up to 6 ppm. For all adsorbents, the adsorptive capacities of parathion were two to three times the adsorptive capacities of carbaryl. Romney soil organic matter with hydrogen on the exchange sites was found to adsorb much more carbaryl and parathion than with calcium on the exchange sites. Water vapor adsorption isotherms showed the hydrogen saturated organic matter to have a much more hydrophobic nature than the calcium saturated organic matter. A similar direct relationship between the hydrophobic nature of the adsorbent surface and the extent of adsorption was found for a carbaryl cation exchange resin with calcium and hydrogen saturation. A non-ionic hydrophobic resin gave very large adsorptive capacities. Differences in the adsorptive capacities between the organic matter adsorbents derived from different soils were relatively slight.
W70-09184

COMPOSITION OF WATER IN CLINCH RIVER, TENNESSEE RIVER, AND WHITEOAK CREEK AS RELATED TO DISPOSAL OF LOW LEVEL RADIOACTIVE LIQUID WASTES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-09194

A MODIFICATION OF THE BENZENE SYNTHESIS METHOD FOR TRITIUM ANALYSIS,
Florida State Univ., Tallahassee.
For primary bibliographic entry see Field 02K.
W70-09213

WATERSHED HUMAN-USE LEVEL AND WATER QUALITY,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05B.
W70-09240

BOD MASS BALANCE AND WATER QUALITY STANDARDS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Jr.
Water Resources Research, Vol 6, No 3, p 827-837, June 1970. 11 p, 11 fig, 2 tab, 12 ref. Project B-002-NJ.

Descriptors: *Water pollution sources, *Water pollution control, *Mathematical models, *Systems analysis, *Sampling, Data collections, Biochemical oxygen demand, Waste disposal, Sewage treatment, New Jersey, Biodegradation, Path of pollutants, Standards, Urbanization.

ntifiers: BOD mass balance, Water quality standards.

establish appropriate water quality controls, the gnitude of the gross pollution load of a basin uld be known. Usually it is not. Mathematical deling of basinwide BOD relationships can be tly facilitated by applying known equations on asis of BOD mass loading rather than of BOD centration. The necessary hydrologic basis indes travel time dye tests, data as to slopes and ances, and computation of travel times for all s of the basin at various stages. Treatment plant instream BOD records are essential. The basic D removal parameter must be computed and sted for different conditions. The remaining putations require a computer but are not espely difficult. The principal reservation as to accuy of the results consists of the allowance that t be made for nitrogenous BOD. Applications his method to three New Jersey basins indicate in each case the recorded BOD data from tment plants account for less than half of the l pollution loading entering the stream. The cy implication is that it is inappropriate to plan er quality standards and programs of corrective asures on the assumption that recorded effluents stitute the only major source of pollution. (K-p-USGS)
0-09349

RATE VARIATION IN GROUNDWATER,
sconsin Univ., Madison. Water Resources ter.
by T. Crabtree.
ailable from NTIS as PB-193 707, $3.00 in er copy, $0.65 in microfiche. Supplementary port, (1970). 60 p, 8 tab, 9 fig, 87 ref, append. RR B-004-WISC (10).

scriptors: *Nitrate, *Wells, *Nitrite, *Coliform, ology, Wisconsin, *Groundwater, Water mistry, *Water analysis.

e nitrate content of approximately 250 private lls representing 20 townships in Marathon Counand several wells from outside the county were estigated. Nitrate, nitrite and coliform contents some 80 wells from Rib Falls-Rietbrock were nitored twice a month for over a year. Seventy cent of wells contained nitrate level of greater n 45 mg/l nitrate at one time or another within a riod of a year and about 45 per cent of the wells ntained excess of 45 mg/l nitrate throughout the ar. Nitrate contents usually were highest during heavy rainy season (April - June). There was no arly defined relationship between depth of wells d high nitrate content, probably owing to pervisness of soil and existence of extensive fractures d crevices in the bedrock. Similarly, wells from ade A milk suppliers were analyzed and it was nd that 44 per cent of 59 well water samples had rate content greater than 45 mg/l. Likewise, rate content of 64 wells from nondairy farmers re analyzed and approximately 35 per cent of ll water samples contained greater than 45 mg/l rate. (See also W70-09426).
70-09425

N ANALYTICAL METHOD FOR EVALUATG THE SUSCEPTIBILITY OF FISH SPECIES O AN AGRICULTURAL CHEMICAL APANESE),
ara Agricultural Chemicals Inst., Shimizu apan).
mio Nagasawa, Shoji Asano, and Kazunobu ndo.
glish summary. Japanese Journal of Applied Enmology and Zoology, Vol 8, No 2, p 118-122, 64. 3 ref, 1 tab, 1 fig.

escriptors: *Regression analysis, *Mathematical udies, *Bioassay, *Test procedures, Mortality, ariability, Analysis, *Evaluation, Water pollution fects.
entifiers: Body weight, Dojo fish, Goldfish.

If the variance of size of test organisms used in the biological assay experiment of chemicals is large, the dosage applied must be corrected corresponding to their size. 'Size factor' for equalizing individual differences in body weight can be calculated by the multiple regression equation. The survival time after immersion was determined as the function of dosage and body weight. Based on this idea, a comparative test on susceptibility to E1-43,064 between the goldfish and 'Dojo' fish was made by the dipping method. The result has shown that the 'Dojo' fish is 5.32 times as susceptible as the goldfish to E1-43,064. (Sjolseth-Washington)
W70-09433

5B. Sources of Pollution

HYDROCHEMICAL REGIME AND SALT BALANCE OF OTKAZNENSKIY RESERVOIR IN THE FIRST YEAR OF ITS EXISTENCE (1966),
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 02K.
W70-09098

SELF-PURIFICATION OF NATURAL WATERS FROM CARBOHYDRATES,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
L. G. Shaova, and V. T. Kaplin.
Translated from Hydrochemical Materials (Gidrohkimicheskiye Materialy), Vol 49, p 166-174, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 171-177, 1969. 7 p, 8 fig, 10 ref.

Descriptors: *Biodegradation, *Waste assimilative capacity, *Stream flow, *Self-purification, Laboratory tests, Oxidation, Nitrification, Ammonia, Water pollution effects, Path of pollutants, Nutrients, Organic matter.
Identifiers: *Carbohydrate biodegradation, USSR.

A study was made to determine the self-purification in natural waters of pollution by various classes of hydrocarbons (monosaccharides and polysaccharides): glucose, sorbose and maltose, which may be present in the waste water of the food industry. Decomposition of glucose, sorbose, and maltose depends insignificantly on the initial concentration of the substance and practically terminates on the 4th day. Oxidation of hydrocarbons in natural water under laboratory conditions occurs mainly as a result of biochemical oxidation and is accompanied by a considerable increase in the number of saprophytic microflora (to 100,000/ml) and a decrease in the concentration of oxygen dissolved in the water. Ammonification slows down during the self-purification of water from hydrocarbons. A slight slowing down of nitrification is observed only at a hydrocarbon concentration exceeding 25 mg/liter. (Knapp-USGS)
W70-09100

OXIDATION OF ALCOHOLS AND THEIR INFLUENCE ON THE SELF-PURIFICATION OF NATURAL WATERS,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR); and All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
L. P. Sokolova, and V. T. Kaplin.
Translated from Hydrochemical Materials (Gidrokhimicheskiye Materialy), Vol 49, p 175-182, 1969. Soviet Hydrology: Selected Papers, Issue No 2, p 177-183, 1969. 7 p, 5 fig, 1 tab, 15 ref.

Descriptors: *Biodegradation, *Alcohols, *Waste assimilative capacity, *Self-purification, *Stream flow, Laboratory tests, Oxidation, Nitrification, Ammonia, Water pollution effects, Path of pollutants, Nutrients, Organic matter.
Identifiers: *Alcohol biodegradation, USSR.

The kinetics and mechanism of decomposition of individual aliphatic alcohols and aldehydes in natural bodies of water and their effect on natural self-purification were studied for methyl and ehtyl alcohols and formaldehyde. Study of the decomposition rate of alcohols in natural water with allowance for the dynamics of saprophytic microflora showed that during intense alcohol decomposition the number of colonies increased sharply. Propanol and pentanol show a tendency to slow down the development of the saprophytic microflora to the extent that the number of colonies even decreased in the first day of the experiment. This decrease was followed by increased multiplication of the bacteria. The biochemical oxidation of alcohols is the main and decisive process leading to the decrease in the concentration of alcohols in natural bodies of water. The oxidation of alcohols results in a sharp decrease of the oxygen dissolved in water and this may have a harmful effect on the oxygen regime. The alcohols tested have a significant effect on nitrification and ammonification processes. The content of ammonium ions increases and nitrification is slowed down considerably in the presence of alcohol. (Knapp-USGS)
W70-09101

THE PROTECTION OF GROUNDWATER RESOURCES.
National Water Well Association, Columbus, Ohio.
For primary bibliographic entry see Field 02F.
W70-09127

RESEARCH NEEDS ON THERMAL AND SEDIMENTARY POLLUTION IN TIDAL WATERS.
American Society of Civil Engineers. Committee on Tidal Hydraulics of the Hydraulics Div.

Journal of the Hydraulics Division, Proceedings of ASCE, Vol. 96, No. HY7, Proc. Paper 7426, July 1970, p1539-1548, 7 ref.

Descriptors: *Thermal pollution, *Sediment discharge, *Tidal waters, Stratification, Estuarine, Environment, Research and development, Sediment transport, Water quality, Hydraulics, Physics, Dispersion, Heat transfer.
Identifiers: *Sedimentary pollution, Hydraulic environment.

When recently requested to identify the most pressing research need in its field, the ASCE Tidal Hydraulics Committee quickly arrived at the concensus opinion that thermal and sedimentary pollution of tidal water bodies was the major problem in need of research in its respective field. The report describes the nature of this problem and includes a review of the literature and some related research. The report outlines general and specific research needs in both thermal and sedimentary pollution and includes a section on instrumentation. It recommended detailed studies as follows: 1. An assessment of sedimentary and thermal pollution problems in selected estuaries of various characteristics. 2. A comprehensive assessment of the state-of-the-art understanding of thermal and sedimentary pollution in tidal waters. (Hsieh-Vanderbilt)
W70-09161

HEAT WASTE,
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
Bob Stearns.
Sea Frontiers, Vol. 16, No. 3, May-June, 1970, p154-163, 6 fig.

Descriptors: *Heated water, *Nuclear powerplants, *Cooling water, *Tropical regions, *Estuarine environment, Heat flow, Vegetation, Isotherm, Human population, Coasts, Distribution patterns, Cooling towers, Canals.
Identifiers: *Population control, Capital tax.

Florida Power and Light Company is constructing a combination conventional (in operation) and nuclear (under construction) electric powerplant at Turkey Point on the southwestern shoreline of Biscayne Bay. This area is of special interest since it is the first nuclear power plant under construction in a tropical or near tropical area. It was observed that temperature at the effluent canal exists averaging 9 deg to 11 deg F above bay ambient and the thermal plume position is persistent. Significant damage of bottom vegetations was observed. Many cooling methods were discussed. Due to the huge size of plant, hurricane force winds and drift problem, no satisfactory cooling method can be achieved. The author suggested that whole population control or population density control should be done before we can solve the problem of increasing power demands. (Hsieh-Vanderbilt)
W70-09162

BUOYANT PLUMES AND THERMALS,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
J. S. Turner.
Annual Review of Fluid Mechanics, Vol. 1, p 29-44, 1969, 3 fig, 53 ref.

Descriptors: *Turbulence, *Buoyancy, *Geothermal studies, Convection, Density, Reynolds number, Profiles, Velocity, Clouds, Air circulation, Condensation.
Identifiers: *Plume, Entrainment, Similarity argument.

This chapter summarizes the literature covering a variety of phenomena that can be related under the general heading of turbulent buoyant convection from small sources. The studies are generally based on laboratory experiments and therefore the assumption is made that the form of the buoyancy source and the environmental conditions can be specified in advance and that these remain unchanged during the whole time the plume or thermal is being studied. The plumes and thermals are first considered in a uniform environment. For both plumes and thermals, the proportional rate of entrainment depends inversely on the radius. However, the rate of dilution of thermals is much greater than for plumes. It should be noted that no way has been found so far to deal numerically with the sharp boundary between the turbulent buoyant fluid and its surroundings. In an unstable environment, similarity arguments can also be used to exhibit some important features of convection from small sources. Yet, in a stable environment, initial conditions and density distributions are needed for the similarity argument. (Osborne-Vanderbilt)
W70-09168

A KINETIC AND EQUILIBRIUM STUDY OF THE ADSORPTION OF THE ORGANIC INSECTICIDES CARBARYL AND PARATHION UPON SOME SOIL ORGANIC MATTER SURFACES,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05A.
W70-09184

NOTES ON A THEORY OF THE THERMOCLINE,
Scripps Institution of Oceanography, La Jolla, Calif.
Walter H. Munk, and Ernest R. Anderson.
Journal of Marine Research, Vol 7, No 3, p 276-295, November 1948. 7 fig, 4 tab, 8 ref.

Descriptors: *Thermocline, *Currents (Water), *Heat flow, *Water temperature, Solar radiation, Convection, Winds, Shear stress, Latitudinal studies, Turbidity, Salinity, Bathythermographs, Stability
Identifiers: *Eddy viscosity, Eddy conductivity.

In this report, the function for eddy viscosity introduced by Rossby and Montgomery and a newly derived function for eddy conductivity are substituted into the differential equations governing the distributions of temperature and current. The equations are then solved simultaneously. In view of the difficulty experienced in selecting conditions under which heat loss by evaporation is relatively small compared to heat gain by radiation, it would appear that convective stirring is as important as wind stirring in many, and perhaps most, cases. The results of the report indicate: (1) that the sharp transition between the mixed layer and the thermocline can be accounted for theoretically by letting the eddy coefficients be functions of the stability and shear; (2) that the theory gives a thermocline depth which, although too shallow, is of the right order of magnitude; (3) that this depth depends on wind speed, latitude, heat flux, and the temperature salinity correlation, in the order stated; and (4) that the variation with each of these factors occurs in a reasonable direction. (Osborne-Vanderbilt)
W70-09191

COMPOSITION OF WATER IN CLINCH RIVER, TENNESSEE RIVER, AND WHITEOAK CREEK AS RELATED TO DISPOSAL OF LOW LEVEL RADIOACTIVE LIQUID WASTES,
Geological Survey, Washington, D.C.
R. J. Pickering.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C - 20402. Price $0.30. U S Geological Survey Professional Paper 433-J, p J 1 - J 15, 1970. 15 p, 4 fig, 6 tab, 39 ref.

Descriptors: *Radioactive waste disposal, *Water pollution sources, *Water pollution effects, *Path of pollutants, Streamflow, Sediments, Adsorption, Absorption, Chemical precipitation, Clay minerals, Calcium carbonate.
Identifiers: *Oak Ridge National Laboratory, Tennessee River, Clinch River, Whiteoak Creek.

Radioactive wastes from the Oak Ridge National Laboratory are released to Whiteoak Creek. Samples of water were taken at seven sampling stations during a period of 3 years and composited into weekly or monthly samples according to streamflow. Determinations were made of physical parameters and of the content of stable chemical constituents, radiochemical constituents, and suspended sediment in the composite samples. The water is of the calcium bicarbonate types. Tennessee River water is similar in composition to Clinch River water and the water of Whiteoak Creek, but contains somewhat less bicarbonate, calcium, magnesium, and suspended and dissolved solids, and somewhat more sodium and chloride. Whiteoak Creek is more highly mineralized than the other two streams, and has more sulfate, nitrate, phosphorus, and sodium. Most of the cesium-137 entering the Clinch River in Whiteoak Creek water was associated with suspended solids. In the Tennessee River, cesium-137 was either dissolved in the water or associated with solids of colloidal or near-colloidal size. Much of the strontium-90 present in Whiteoak Creek water may be associated with precipitated calcium carbonate. Close similarities in variations in concentration between ruthenium-106 and cobalt-60 in both Whiteoak Creek and the Clinch River, and their correlation with nitrate reflect their common origin in high-nitrate solutions released to the basin of Whiteoak Creek. (Knapp-USGS)
W70-09194

NEW YORK METROPOLITAN REGION--A MAJOR SEDIMENT SOURCE,
State Univ. of New York, Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 02J.
W70-09203

DISPERSION IN HOMOGENEOUS ESTUARY FLOW,
Illinois Univ., Urbana; Massachusetts Inst. of Tech. Cambridge; and California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02L.
W70-09217

STRONTIUM 90 CONCENTRATIONS IN SURFACE AIR: NORTH AMERICA VERSUS ATLANTIC OCEAN FROM 1966 TO 1969,
New York Operations Office (AEC), N.Y. Health and Safety Lab.
For primary bibliographic entry see Field 02B.
W70-09229

WATERSHED HUMAN-USE LEVEL AND WATER QUALITY,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
Roger D. Lee, James M. Symons, and Gordon G. Robeck.
Journal American Water Works Association, Vol 62, No 7, p 412-422, July 1970. 11 p, 12 fig, 9 tab, 18 ref.

Descriptors: *Water quality, *Water supply, *Watersheds (Basins), *Pacific Northwest U.S., *Watershed management, Surface waters, Coliforms, Bioindicators, Water management (Applied), Water policy, Multiple purpose.
Identifiers: *Watershed use.

A study was conducted from December 1966 through September 1967 to measure the physical, chemical, and microbiological quality of water flowing from three watersheds in the northwestern part of the United States. These watersheds were those of the Cedar and Green Rivers in Washington, and the Clackamas River in Oregon. The watersheds are similar in environmental factors such as terrain, elevation, forest cover, and meteorological conditions but vary in their human use. The Cedar watershed is well protected; the Green watershed has some resident population and limited recreational use; and the Clackamas watershed is open for unrestricted access and unlimited recreation. By present techniques, no measurable influence could be determined on bacterial indicator population densities because of the increase in human use level among the Cedar River, the Green River, and the Clackamas River watersheds. The animal population on all three watersheds was much higher than the human use level and generally similar among watersheds. (Knapp-USGS)
W70-09240

LEAD IN A SUBURBAN ENVIRONMENT,
For primary bibliographic entry see Field 02K.
W70-09251

DISSOLVED SOLIDS-DISCHARGE RELATIONSHIPS: 1. MIXING MODELS,
New Hampshire Univ., Durham.
For primary bibliographic entry see Field 02K.
W70-09311

POLLUTION OF ESTUARIES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05C.
W70-09383

DETERGENTS, PHOSPHATES, AND WATER POLLUTION,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 05C.
W70-09388

A SYSTEM APPROACH FOR THE STUDY AND CONTROL OF FACTORS AFFECTING WATER POLLUTION,
Mississippi State Univ., State College. Water Resources Research Inst.
Abdel-Razek Abouel-Nour.
Available from NTIS as PB-193 720, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Water Resources Research Institute, July

70. 48 p, 1 tab, 15 fig, 8 ref. OWRR Project A-9-MISS (1).

scriptors: Water pollution control, Regression alysis, *Systems analysis, Mississippi, Decomposs organic wastes, Biochemical oxygen demand, ssolved oxygen, *Water quality, Degradation ecomposition), *Numerical analysis, *Water llution sources, Computer programs.
ntifiers: *Pear River (Miss).

e objectives of the research were directed ward testing the feasibility of applying a system proach for the study of pollutants and/or quality tors in a river. The Pearl River and its major outaries were selected to implement the study. ality data of the research areas were supplied by r and Water Pollution Control Commission, ckson, Mississippi. Preliminary analysis of the arl River data suggested treating it by dividing it o reaches. For example, the regression equations the biochemical oxygen demand (BOD), and solved oxygen (DO) for two consecutive reaches ne of them is heavily polluted) underestimate the imate degradation in qualities near the signifi-nt organic waste source. Seven reaches have en used for the Pearl River and its major tributa-s. Stepwise multiple regression FORTRAN pro-am has been compiled and run under an IBM 360 stem for regressing the quality factors of each ach. The quality characteristics of the surface aters have been mathematically explained. Five ts of regression equations, each describing the alities of water in one reach during short and dry riods, were obtained. Another two sets of regres-on equations describing the qualities of water in e river at the city of Bogalusa, Louisiana, one set r the year 1967 and the other for the year 1968, ere also obtained. Within limitations imposed by e data, the regression equations can be used for rposes of prediction. Application of the regres-on equations to include two consecutive reaches iled in statistical tests.
70-09422

HE EFFECT OF SALINITY ON THE OXIDA-ION OF HYDROCARBONS IN ESTUARINE NVIRONMENTS,
lississippi State Univ., State College. Water esources Research Inst.
. R. Brown, W. E. Phillips, Jr., and J. M. ennyson.
vailable from NTIS as PB-193 706, $3.00 in aper copy, $0.65 in microfiche. Completion Re-ort, Water Resources Research Institute, July, 970. 28 p, 2 tab, 10 fig, 5 ref, append. OWRR Pro-ect A-034-MISS (1).

escriptors: Microbiology, Oil, *Oily water, *Ox-lation, *Hydrocarbons, *Salinity, Estuarine en-ironment, *Degradation (Decomposition), Water ollution sources.
dentifiers: Petroleum degradation.

he physical changes observable during the nicrobial degradation of refined motor oil under onditions of varying salinity indicated a more apid degradation in samples inoculated with bot-om deposits than did those containing just the verlying seawater. These changes were compara-le to those observed in previously conducted fresh vater studies. The rate of oxygen consumption dur-ng the microbial degradation of naphthenic crude il and refined motor oil at various salinities in-licated that more rapid degradation occurred in amples with salinities ranging from 17-34 parts per 000. In all probability these results could be at-ributed to the fact that the inocula were derived rom bottom samples with overlying waters having alinities in these ranges, confirming previous stu-dies which indicated that the origin of the inoculum had a significant effect on the rate of decomposi-tion. It was concluded that while each individual petroleum product will be degraded at a different rate, rates at different salinities will be comparable if the inocula employed in the studies are derived from that salinity. Predominant types of bacteria occurring at different salinities have been isolated and changes in the bacterial population which oc-curred during microbial degradation have been noted and representative species isolated and identified. The naphthenic crude oil appeared to be a more selective substrate since only one genus (P-seudomonas) predominated at the end of incuba-tion, whereas three (3) or more microbial types were evident at the termination of the experiment employing refined motor oil. A number of in-vestigators have asked the question as to whether or not the anaerobic decomposition of hydrocar-bons does occur. While the results reported in this investigation do not answer the question, it can be said that under the conditions employed anaerobic decomposition of hydrocarbons appears to have taken place. The presence of water-isoluble, petroleum ether-insoluble materials in the 'oil layer' was shown as well as the production of ap-preciable amounts of hydrogen sulfide.
W70-09424

A STUDY OF FARM WASTE, FARM ANIMAL WASTE: CHARACTERIZATION, HANDLING, UTILIZATION,
Wisconsin Univ., Madison.
S. A. Witzel, O. J. Attoe, E. McCoy, L. B. Polkowski, and K. Crabtree.
Available from NTIS as PB-193 708, $3.00 in paper copy, $0.65 in microfiche. Supplementary Report, (1970). 141 p, 6 ref, 4 append. OWRR Project B-004-WISC (11).

Descriptors: *Animal wastes, *Waste storage, *Aerobic treatment, *Anaerobic digestion, Surface runoff, Fertilizer, Sewage bacteria, Percolation, Lagooning, Wisconsin.
Identifiers: *Bovine waste, *Groundwater pollution, Fertilizer effectiveness.

The farm animal waste problem in Wisconsin is multifaceted. Not only are there the usual aspects like kinds of animal manures, differences in farming practices (including size of herds, feeds and manner of feeding) but also there are problems because of the geographic location of the state. Its long cold winters enforce at least a consideration of 4-6 months of storage to avoid spreading of manure on frozen ground. Secondly, its glaciated soils present locally different bedrock and soil permeability. In the southern half of the state where both farming and population are concentrated, the waters are hard and fractured limestone formations underlie much of the area. Attention is now being called to the possible pollution of groundwater. And lastly, Wisconsin is a state of lakes and streams, many of which are undergoing critical eutrophication. Farm manure and fertilizer are being blamed at least in part, and thus surface water run-off, enriched by manure spread on hilly land, is a special problem. (See also W70-09425).
W70-09426

GIBSON V CITY OF TAMPA (POLLUTION OF OYSTER BEDS BY UNTREATED MUNICIPAL SEWAGE).

185 So 319-321 (Fla 1938).

Descriptors: *Florida, *Sewage effluents, *Water pollution effects, *Oysters, Leases, Water rights, Pollutants, Municipal wastes, Waste treatment, Sewage disposal, Cities, Bays, Oceans, Water pollution, Sewage, Public health, Water law, Public rights, Local governments, Legislation, Legal aspects, Judicial decisions, Eminent domain, Condemnation, Relative rights.
Identifiers: *Oyster contamination.

Plaintiffs held leases from the state authorizing them to cultivate oysters in Hillsborough Bay, and had built up a valuable oyster business. Plaintiffs brought action against defendant city for damages resulting from the city's practice of dumping raw, untreated sewage into the bay thereby contaminating plaintiffs' oysters, the sale of which was prohibited by defendant city's public health officials. Plaintiffs contended that state law protected their investment in the oyster bed leases. Defendant relied upon the common law right of a municipality to empty its sewage into the sea. The court held that state statutes providing for the propagation and cultivation of oysters, and important industry in Florida, materially altered defendant's common law sewage disposal rights. The court also found that plaintiffs' oyster leases were valuable property rights and could not be taken or damaged without compensation, and remanded the case for a determination of damages. (Liptak-Florida)
W70-09485

AGRICULTURAL WASTES AND THE ENVIRONMENT,
Ohio State Univ., Columbus. Dept. of Agricultural Engineering.
E. Paul Taiganides.
Agricultural Engineering, Vol 51, No 6, p 358-359, June 1970.

Descriptors: *Farm wastes, Water pollution sources, Effects, Irrigation effects, Insecticides, Nitrates.

Agricultural wastes contribute fifty percent of the sediment load in rivers in the United States. Animal wastes, crop residues, in addition to insecticides, fertilizers, waste waters from agrochemical processing plants make up these polluting agricultural wastes. The author contends that 'recycling these wastes into the production system' is the only effective way to manage these wastes. (Holmes-Rutgers)
W70-09498

5C. Effects of Pollution

FACTORS AFFECTING THE MOVEMENT OF WATER AND ORGANISMS WITHIN A REGULATED MULTIPURPOSE LAKE,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 02H.
W70-09090

WATER QUALITY IN RELATION TO PRODUCTIVITY OF LAKE ASHTABULA RESERVOIR IN SOUTHEASTERN NORTH DAKOTA,
North Dakota Water Resources Research Inst., Fargo.
John J. Peterka.
Available from NTIS as PB-193 683, $3.00 in paper copy, $0.65 in microfiche. Research Project Technical Completion Report, WI-221-002-69, March 1969. 23 p, 4 tab, 7 fig, 18 ref. OWRR Project A-004-NDAK (1).

Descriptors: Reservoir, *Primary productivity, *Eutrophication, Water quality, *Nutrients, Limnology, Water temperature, *Algae blooms, Cyanophyta, North Dakota.
Identifiers: Lake Ashtabula.

This study attempts to relate the chemical and physical characteristics of the lake water to standing crops and production rates of phytoplankton. The average gross photosynthesis rate was 41 percent of the optimal rate. PHYTOPLANKTON STANDING CROPS AVERAGED <$ UG CHLOROPHYLL/LITER IN THE EUPHOTIC ZONE. Optimal photosynthesis per unit chlorophyll averaged 13.5 mg 02/mg chlorophyll/hour. Gross production per unit chlorophyll decreased with increase in phytoplankton standing crop. Annual gross photosynthesis was 1.4 gC/m2/day. Three empirical equations were used to predict photosynthesis in the euphotic zone. Gross photosynthesis was related to standing crop and water temperature, but not to CO2 or macro-nutrients. High nutrient levels and continual circulation of the water during ice-free periods made the lake eutrophic. (Peterka-North Dakota State)

W70-09093

SELF-PURIFICATION OF NATURAL WATERS FROM CARBOHYDRATES,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR).
For primary bibliographic entry see Field 05B.
W70-09100

OXIDATION OF ALCOHOLS AND THEIR INFLUENCE ON THE SELF-PURIFICATION OF NATURAL WATERS,
Nauchno Issledovatelskii Gidrokhimicheskii Institut, Novocherkassk (USSR); and All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 05B.
W70-09101

THE TEMPERATURE SELECTION OF SMALL HYPOPHYSECTOMIZED GOLDFISH, (Carassius auratus L.),
Queen's Univ., Kingston (Ontario). Dept. of Biology.
A. W. Roy, and P. H. Johansen.
Canadian Journal of Zoology, Vol 48, No 2, March 1970, p 323-326, 1 fig, 1 tab, 15 ref.

Descriptors: *Water temperature, *Physiological ecology, *Fish, *Fish physiology, Bioassay, Temperature control.
Identifiers: *Temperature selection, *Horizontal temperature gradient, Goldfish, Pituitary hormones, Hypophysectomy, Nervous system.

The selected temperature ranges of unoperated, sham-operated, and hypophysectomized goldfish were determined in the horizontal temperature gradient. Hypophysectomy did not alter the selected temperature of small goldfish. Three hypotheses can be offered to explain the results. The simplest is that the pituitary is not essential for the maintenance of the temperature selection response by goldfish. The second hypothesis is that neurohypophysis may be involved, since there is evidence that, in at least some hypophysectomized goldfish, a seemingly homologous structure is the hypophyseal area has been found by Sathyanesan and Gorbman. The third is that a balance of pituitary hormones influences the nervous system so that the response is changed with the season as well as acclimatization temperature, and that once the change has been effected, the hormones play no further role and hence their absence has no influence. The last hypothesis could be tested by further work. (Hsieh-Vanderbilt)
W70-09151

TEMPERATURE-DEPENDENT CHARACTERISTICS OF PERIPHERAL NERVES EXPOSED TO DIFFERENT THERMAL CONDITIONS IN THE SAME ANIMAL,
Institute of Arctic Biology, Alaska University, College, Alaska.
L. Keith Miller.
Canadian Journal of Zoology, Vol. 48, No. 1, Jan. 1970, p75-81, 5 fig, 3 tab, 10 ref.

Descriptors: *Cold resistance, *Beavers, *Temperature, Conduction.
Identifiers: *Nerves, *Peripheral nerves, Caudal nerves, Phrenic nerves, Tibial nerves, Excitability, Refractory period, Action potential characteristics, Vitro.

Beaver (Castor canadensis) caudal nerves, accustomed to tissue temperatures approaching 0 deg C, were compared with nerves that encounter less severe cooling (Tibial), and nerves that are accustomed only to deep body temperature (phrenic). Caudal nerves invariably conducted action potentials until freezing at about -5 deg C. Tibial nerves ceased conducting at 0 deg C and phrenic nerves failed at 4.5 deg C. Conduction velocity-temperature slopes of the three nerves were different and absolute refractory periods in the cold-adapted nerves were significantly shorter at low temperature. Results furnish additional proof of cold adaptation in peripheral nerve. (Hsieh-Vanderbilt)
W70-09160

EFFECTS OF THERMAL DISCHARGE FROM THE SAN ONOFRE NUCLEAR GENERATING STATION,
Southern California Edison Co., Los Angeles. Dept. of Mechanical Engineering.
J. N. Reeves.
Proceedings of the Industrial Waste Conference, 23d, Typescript 19 p.

Descriptors: *Thermal pollution, *Nuclear powerplants, *Cooling water, *Oceanography, *Marine fisheries, *Marine plants, *Monitoring, *On-site investigation, Aquatic environment, Outlets, Seashores, Water quality, Temperature, Isotherms, Dissolved oxygen, Bottom sediments, Turbulence, Hydrogen ion concentration.
Identifiers: Kelp, Distribution of kelp beds, Marine biology.

The purpose of this oceanographic monitoring program are to quantitatively and qualitatively describe features of the ocean environment prior to San Onofre plant operation and to evaluate effects which the plant might have on the marine biological community after plant operation begins. The study includes biological observations at five stations along the beach, monitoring the benthic biology at six diving stations offshore and various water quality parameters such as pH, temperature, dissolved oxygen, turbidity, and bottom sediments at 32 hydrographic stations. This report concludes that no significant adverse effects on the general marine environment have been observed which can be associated with the operation of the San Onofre Station which uses 350,000 GPM cooling water. The author believes that this study has demonstrated that the San Onofre plant is compatible with its environment and that the beneficial uses of the marine adjacent to the plant site are being fully protected. (Hsieh-Vanderbilt)
W70-09165

EFFECT OF TEMPERATURE AND SALINITY ON THE HEAT TOLERANCE IN THE HERMIT CRAB, DIOGENES BICRISTIMANUS,
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
R. Nagabhushanam, and R. Sarojini.
Hydrobiologia, Vol. 34, Fasc. 2, Nov. 1969, p 126-134, 10 fig, 12 ref.

Descriptors: *Temperature, *Salinity, *Bioassay, *Heat resistance, Crabs, Invertebrates, Acclimatization, Lethal limits, Tidal effect.
Identifiers: *Diogenes bicristimanus, Hermit crab.

The influence of laboratory acclimatization to various temperature-salinity combinations on the heat tolerance of the hermit crab, Diogenes bicristimanus, was determined. In experiment I, the temperature of 50% survival in (1) base line (35 deg C and 30% salinity), and acclimatized at (2) 35 deg C and 30%, (3) 35 deg C and 5%, (4) 22 deg C and 30%, (5) 22 deg C and 5% were 38.3 deg C, 45.1 deg C, 40.4 deg C, 32.7 deg C, and 31.5 deg C, respectively. In experiment II, the temperatures of 50% survival in (1) base line (22 deg C and 5%), and acclimatized at the same combinations as in experiment II. (2), (3), (4), and (5) were 27.0 deg C, 38.2 deg C, 37.4 deg C, 30.8 deg C, and 29.05 deg C respectively. It was concluded that acclimatization to a high temperature generally increased resistance to lethal temperature, whereas acclimatization to low salinity generally decreased it. High temperature and high salinity was the most favorable acclimatization combination to withstand the high test temperature. Gain in heat tolerance, whether the salinity was low or high, was rapid. (Hsieh-Vanderbilt)
W70-09166

TEMPERATURE, REPRODUCTION AND BEHAVIOR,
Battelle Memorial Inst., Richland, Wash.
Charles C. Coutant.
Chesapeake Science, Vol. 10, No. 3 and 4, p 261-274, Sept-Dec, 1969, 15 fig, 2 tab, 2 ref.

Descriptors: *Salmon, *Thermal pollution, *Fish reproduction, *Fish behavior, Nuclear reactors, Fishing, Trout, Periphyton, Fish eggs, Water temperature, Columbia River, Spawning, Fish migration, Predation, Tagging.

Current research being conducted on salmonid fishes at the Hanford nuclear complex on the Columbia River is discussed. Studies of thermal effects on reproduction are concerned with two questions. Will the locally spawning fall race of chinook salmon continue to spawn in river areas affected by thermal discharges and will eggs spawned in warmed water have abnormal rates of mortality and growth. In answering these questions, a 20 year, annual census of spawning chinook salmon near reactor discharges and laboratory experiments on incubation and rearing success at elevated temperatures were undertaken. The results showed that a slight temperature rise of only 4 deg F gives a mortality rate that is still permissible, however, greater temperature rises often create mortality rates that are too great. Nevertheless, the higher temperatures help develop a larger size of young salmon which are more capable of protecting themselves against their natural enemies. Currently, investigations concerning the affected behavior of salmonids are underway. Major emphasis is on the problem of loss of equilibrium, changes in susceptibility to predation, and changes in migration paths of adult chinook salmon. (Osborne-Vanderbilt)
W70-09170

RESERVOIR EFFECT ON DOWNSTREAM WATER TEMPERATURES IN THE UPPER DELAWARE RIVER BASIN,
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 05A.
W70-09171

THE EFFECT OF BIOLOGICAL LIFE ON THE DISSOLVED OXYGEN CONCENTRATION IN THE DELAWARE RIVER,
Drexel Univ., Philadelphia, Pa. Dept. of Civil Engineering.
William L. Zemaitis, and Geraldine V. Cox.
Prepared for the City of Philadelphia Water Department. Drexel University, Department of Civil Engineering, Philadelphia, July 1970. 13 p, 10 fig, 6 tab, 131 ref. Work No. P-244, Contract No. 88-2239.

Descriptors: *Sludge worms, *Dissolved oxygen, *Eutrophication, *Biochemical oxygen demand, *Chemical oxygen demand, *Water pollution sources, *Water pollution effects, *Organic matter, *Oxygen sag, *Impaired water quality, *Estuaries, *Delaware River, Vegetation effects, Sludge, River beds, Algae, Mathematical models.
Identifiers: *Delaware Estuary, *Biological life, *Dissolved oxygen concentration.

Describes an investigation of the effects of biological life on the dissolved oxygen content in the Delaware Estuary. Biological, chemical, and physical tests were conducted for eighteen months. Benthal surveys revealed that turbificids (aquatic worms), algae, rooted aquatics, and terrestrial vegetation were present. The turbificids were predominant invertebrate species in the sludge deposits, and the population was great where the sediment contained large amounts of organic compounds. Respiration of mixed communities of invertebrates was determined to be as high as 4.2 mg/l of oxygen per gram of turbificids. One dead gram of dead turbificids was found to create a BOD5 of 200 mg/l. Toxic pollution, with a resulting total kill of turbificids in a region, could cause a 20,000 mg/l/m2 BOD5. The BOD/COD ratio increases represent a very significant secondary pollution of the estuary. A significant amount of natu-

l organics in the form of algae and other vegetaon was found. Settlement of these organics in ower moving waters causes enrichment of the ediment and produces a dissolved oxygen sag elow Trenton during high flow periods when botm scouring takes place. Macrofauna metabolism nd algae oxygenation and deoxygenation were not corporated into mathematical models (developed y others) for the Delaware Estuary. The authors ate that the waste allocations determined from ese models might have differed greatly if all arameters had been considered. Recommendaons for further studies are given. (Poertner)
/70-09189

AVIS V CITIES SERVICE OIL CO (LIABILITY OR DAMAGES CAUSED BY OIL POLLUION).
or primary bibliographic entry see Field 06E.
/70-09243

STATEMENT ON PHOSPHORUS,
innesota Univ., Minneapolis.
or primary bibliographic entry see Field 05D.
/70-09325

NVIRONMENTAL CHANGES PRODUCED BY OLD-WATER OUTLETS FROM THREE ARANSAS RESERVOIRS,
rkansas Univ., Fayetteville. Water Resources esearch Center.
or primary bibliographic entry see Field 06G.
/70-09344

OLLUTION OF ESTUARIES,
Geological Survey, Washington, D.C.
. L. Cory, and J. W. Nauman.
Marine Pollution Bulletin, Vol 1 (NS), No 6, p 87-1, June 1970. 5 p, 2 fig, 3 tab, 3 ref.

Descriptors: *Water pollution effects, *Productivity, *Estuaries, *Thermal pollution, *Maryland, Eutrophication, Nutrients, Thermal powerplants, Heated water, Animals, Environmental effects.
Identifiers: Patuxent Estuary (Md).

The biological effects of industrial effluent discharged into a number of estuaries on the US Atlantic seaboard were examined during the past 7 years. The consequences of discharging hot water from a power station and pulp mill effluent on the epifauna of the estuaries of the North Newport and Patuxent rivers, are discussed. The production of dry weight by the epifauna during 1967 was 2.8 times greater in the power station effluent than in the intake canals. There was also an increase in the numbers of barnacles and hydroids in the effluent canal as well as an extension of settlement; that is, they settled earlier in the spring and later in the fall. Outside the confines of the discharge canal of the power station there was a significant increase in epifaunal production at two stations: one upstream and one downstream from the point of discharge. Both stations produced more dry weight than the uppermost station. The change to highest production in the vicinity of the power station is the result of a combination of increased temperatures, downriver shift of high production waters and an increase in the numbers of attaching larvae. There was also downriver change in species composition and a decrease in species diversity. (Knapp-USGS)
W70-09383

DETERGENTS, PHOSPHATES, AND WATER POLLUTION,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
P. D. Goulden, W. J. Traversy, and G. Kerr.
Canada Department of Energy, Mines and Resources Inland Waters Branch Technical Bulletin No 22, 1970. 8 p.

Descriptors: *Water pollution effects, *Phosphates, *Nitrates, *Nutrients, *Eutrophication, Algae, Surfactants, Water pollution sources, Surface waters, Water pollution, Domestic wastes, Municipal wastes.
Identifiers: Canada.

This report was prepared to provide the general public with technical information on detergents and the effects of phosphates on the water environment. It answers some of the more commonly-asked questions regarding phosphate-based detergents--what they are, what they contain, how they work and how they affect the quality of our water resources. The property of biodegradability as it applies to detergents is explained. While phosphates and nitrates do not in themselves pose any threat to health at the concentrations involved after diffusion in receiving waters, they do possess nutritive properties which encourage the excessive growth of algae and other forms of undesirable aquatic vegetation. When large amounts of this vegetation decompose at the end of the growing period, depletion of the vital life-sustaining dissolved oxygen in water occurs. This form of pollution, which is caused by excess nutrient enrichment, is also referred to as eutrophication and in its extreme form results in the accelerated aging or dying of lakes. (Knapp-USGS)
W70-09388

RELATION BETWEEN THE 'ITAI-ITAI' DISEASE AND THE POLLUTION OF RIVER WATER BY CADMIUM FROM A MINE,
Okayama Univ. (Japan). Ohara Inst.
J. Kobayashi.
Presented at the 5th International Water Pollution Research Conference, held in San Francisco, July - August, 1970. 7 p, 2 ref, 3 tab, 6 fig. U.S.P.H.S. Grant WP-00359.

Descriptors: *Public health, *Heavy metals, *Water pollution sources, *Water pollution effects, *Mine drainage, Mine water, Waste water (Pollution), On-site investigations, Calcium, Human diseases, Bioassay, Toxicity, Poisons.
Identifiers: *Cadmium, Jintsu River (Japan), *Itai-Itai disease, Zinc, Lead, Agricultural damage, *Calcium metabolism.

As a consequence of the discovery of a high content of x Cd, Zn, and Pb in the tissues of the patients suffering from itai-itai disease in a restricted district along the Jintsu River in Japan, there was a strong presumption that the cause of the disease was chronic poisoning by heavy metals found in the waste water from a mine. The following observations were made: (1) Itai-itai disease and damage to rice plants by the waste water appeared in the same place along the banks of the river and decreased at the same time. (2) A heavy accumulation of Cd and other metals was found in the patients' bones, internal organs, soil, and plants. (3) In a laboratory experiment the group of rats which was fed Cd excreted more Ca than that assimilated from the feed, while the control group showed the contrary phenomenon. Thus, the loss of mineral components from the bones was ascertained to be caused by Cd. From these results, it was made clear that the itai-itai disease was induced by cadmium in the waste water from a mine. (Sjolseth-Washington)
W70-09427

EFFECTS OF SUBLETHAL DDT ON A SIMPLE REFLEX IN BROOK TROUT,
Fisheries Research Board of Canada, St. Andrews (New Brunswick).
J. M. Anderson, and H. B. Prins.
Journal of the Fisheries Research Board of Canada, Vol 27, p 331-334, 1970.

Descriptors: *DDT, Pesticide toxicity, Brook trout, Water pollution effects, *Fish behavior, *Fish physiology, Laboratory tests, Laboratory equipment, Persistence.
Identifiers: Central nervous system, *Conditioned response, Learning, Simple reflex.

Brook trout were conditioned in about 30 trials to exhibit the propeller-tail reflex, with electric shock as the unconditioned stimulus and light as the conditioning stimulus. When the trout were exposed for 24 hr to sublethal DDT (20 ppb), more than half could not be conditioned at all; the remainder required significantly more trials than did the untreated ones. Three to four weeks after initial testing, the DDT effect had largely disappeared. It seemed likely that the DDT WAS ACTING UPON CENTRAL NERVOUS SYSTEM STRUCTURES. The general ecological implications of the results are discussed. (Sjolseth-Washington)
W70-09428

TOXICITY STUDIES WITH AN OIL-SPILL EMULSIFIER AND THE GREEN ALGA PRASINOCLADUS MARINUS,
University Coll. of Wales, Aberystwyth. Dept. of Botany.
A. D. Boney.
Journal of the Marine Biological Association of the United Kingdom, (1970), p 461-473. 14 ref, 4 tab, 4 fig.

Descriptors: Bioassay, Toxicity, *Emulsifiers, Detergents, Oil, *Oil wastes, Oily water, Oil-water interfaces, Water pollution treatment, Water pollution effects, Environmental effects, Algal poisoning, Algae, Solvents, Surfactants, Water temperature, Plant pigments, Plant physiology, *Plant pathology, Plant growth regulators, Salinity, Plant populations.
Identifiers: *BP 1002, *Green algae, Prasinocladus marinus, Temperature effects.

Cyst phases of the green alga Prasinocladus marinus have been used in an investigation of the toxic properties of an oil-spill emulsifier BP 1002, and of its solvent and surfactant fractions. Various aspects of a rejuvenation process have all been utilized as a means of assay in addition to observations on cell viability. The 'aged' cysts were more tolerant of all types of toxic agents than were the young non-motile cells. The surfactant fractions were more toxic when used alone, and the solvent fraction alone more toxic than the compounded BP 1002. The application of any of the toxic agents at low temperature (4 deg. C) resulted in a marked reduction in their effects at high concentrations (e.g. 500 ppm). The toxic effect was appreciably increased with both 'aged' and 'young' cells when accompanied by a lowering in salinity. Aeration of the toxic solutions caused a significant lowering of toxicity with both BP 1002 and the solvent fraction. Chloroplast pigment regeneration in 'recovering' cysts was a sensitive means of assaying toxic effects. (Sjolseth-Washington)
W70-09429

AMMONIA TOXICITY IN SELECTED FISHES,
Missouri Univ., Columbia. Dept. of Agricultural Chemistry.
R. P. Wilson, R. O. Anderson, and R. A. Bloomfield.
Comparative Biochemistry and Physiology, Vol 28, p 107-118, 1969. 30 ref, 5 fig.

Descriptors: *Ammonia, Bioassay, *Toxicity, Lethal limit, Ammonium compounds, Rainbow trout, Channel catfish, Resistance, Water temperature, *Fish physiology, Laboratory tests, Enzymes, Biochemistry, Environmental effects, Water pollution effects.
Identifiers: *Ammonium acetate, Goldfish, Ammonotelic fish, Uricotelic fish, Ureotelic fish, *Ammonia toxicity, LD50.

Intraperitoneal LD50 and LD99.9 values for ammonium acetate were determined in three species of ammonotelic fishes; rainbow trout (Salmo gairdnerii), channel catfish (Ictalurus punctatus) and goldfish (Carassius auratus). There was a direct relationship between the LD50 values for ammonium acetate and the relative resistance to environmental conditions, i.e., the trout were the most sensitive, the channel catfish intermediate and the

goldfish quite resistant. An increase in aquarium temperature considerably decreased the fishes tolerance to the injected ammonium acetate. Fishes being ammonotelic were found to be more tolerant to the intraperitoneally administered ammonium acetate than either the ureotelic or uricotelic species. Several factors which may contribute to the higher tolerance of exogenous ammonia in the fishes are discussed. (Sjolseth-Washington)
W70-09430

EFFECTS OF DIQUAT ON BLUEGILLS AND THEIR FOOD ORGANISMS,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Philip A. Gilderhus.
The Progressive Fish-Culturist, Vol 29, No 2, April 1967. p 67-74, 11 ref, 5 tab.

Descriptors: *Diquat, *Sunfishes, Toxicity, Herbicides, Fish physiology, Growth rates, *Fish Food organisms, Aquatic weed control, Water pollution effects, Persistence, Bottom sediments, Spawning, Zooplankton, Daphnia.
Identifiers: Cladocera, *Spawning success, *Diquat residues.

Diquat appeared to be nonhazardous to bluegills in moderately hard water. The fingerlings did not appear to be effected in any way by the herbicide. Hematological and histopathological examinations of adult fish failed to reveal any effect of the chemical. The differences in growth rates of adults from pool to pool appeared to be a function of survival and total weight of fish in the pools, and could not be related to concentration of the chemical. The herbicide showed an acute toxicity to cladocera. In most of the pools, however, the populations of cladocera built up to normal levels after the diquat had disappeared from the water. (Sjolseth-Washington)
W70-09431

COMPARATIVE STUDIES OF THE MOLLUSCICIDAL EFFECT OF CUPROUS CHLORIDE AND COPPER SULFATE IN IRAN,
World Health Organization, Alexandria (Egypt).
K. Y. Chu, J. Massoud, and F. Arfaa.
Bulletin World Health Organization, Vol 39, No 2, p 320-326, 1968. 12 ref, 6 tab.

Descriptors: *Copper sulfate, *Molluscacides, *Evaluation, *Snails, Chemcontrol, Piscicides, Toxicity, Mortality, Fishkill, On-site investigations, Copper compounds, Lethal limit, Bioassay, Water pollution effects.
Identifiers: *Cuprous chloride, Iran, *Bulinus truncatus.

The molluscicidal effectiveness of CuCl was compared to that of CuSO4. In the laboratory in the absence of mud, the compounds were equally effective against Bulinus truncatus in the range 2-32 ppm. using 1-or 13-day-old solutions, but CuCl was more lethal in 43- or 91-day-old solutions. When the experiment was repeated in the presence of mud, CuSO4 was more effective initially (25-400 ppm.). Both, however, rapidly lost their effectiveness when mud was present, and the initial concentrations required were too high to use the compounds effectively for their residual activity. The compounds were then tried on some ponds. For both, 30 ppm. killed and snails immediately, but 9 days later there was no residual activity in the ponds. CuCl at 10 ppm. was as piscicidal as CuSO4, with all fish dying within 96 hrs. Since both compounds are piscicidal as well as molluscicidal, neither is recommended under the field conditions used. (Sjolseth-Washington)
W70-09432

AN ANALYTICAL METHOD FOR EVALUATING THE SUSCEPTIBILITY OF FISH SPECIES TO AN AGRICULTURAL CHEMICAL (JAPANESE),
Ihara Agricultural Chemicals Inst., Shimizu (Japan).
For primary bibliographic entry see Field 05A.
W70-09433

PRELIMINARY RESULTS OF THE EXPERIMENTS ON THE TOXICITY OF OIL COUNTERACTING AGENT (ESSO COREXIT 7664), WITH AND WITHOUT IRAQ CRUDE OIL, FOR SELECTED MEMBERS OF MARINE PLANKTON,
Institut fuer Fischerei, Hamburg (West Germany).
S. A. Latiff.
Archiv fuer Fischereiwissenschaft, Vol 20, Nos 2/3, p 182-185, 1969. 3 ref, 2 tab.

Descriptors: *Bioassay, Oily water, *Oil wastes, Oil-water interfaces, Water pollution effects, Water pollution sources, *Toxicity, *Emulsifiers, Oil, Water pollution treatment, Crustaceans, *Zooplankton, Lethal limit.
Identifiers: *Esso corexit 7664, *Crude oil, *Marine plankton, Pleurobrachia pileus, Coelenterates, Polychaetes, Oil-ex, Anti-oil TS 5, Sillarit, Moltoklar, Peroklean, Slix, Elimax, Gamlen.

Corexit was less toxic than Oil-Ex, Anti-Oil TS 5, Sillarit, Vecom B 24, Struktol J 502, PS 777, Gamlen, Elimax, Slix, Peroklean and Moltoklar (other oil counteracting agents). The addition of crude oil as in the case of Sillarit or Struktol J 502 reinforced the toxicity of Corexit. The lethal limits of corexit for P. pileus, spionid larvae and young Crangon crangon without Iraq crude oil were 0.667, 0.889 and 1.600 ml/l sea water respectively; the corresponding figures after the addition of crude oil were brought down to 0.222, 0.222 and 0.364 ml/l sea water respectively. (Sjolseth-Washington)
W70-09434

TOXICITY OF SELECTED HERBICIDES TO BLUEGILL SUNFISH,
Louisiana Wild Life and Fisheries Commission.
Janice S. Hughes, and James T. Davis.
Proceedings of the Louisiana Academy of Sciences, Vol XXV, p 86-93, 1962. 10 ref, 2 tab.

Descriptors: *Bioassay, *Toxicity, Fishkill, *Sunfishes, *Herbicides, Aminotriazole, 2-4-D, Dalapon, 2-6-Dichlobenil, Diquat, Aquatic seed control, Water pollution effects, Carbamate pesticides, Lethal limit.
Identifiers: Endothal, Diphenamid, Emid, Fenac, Sterox, CIPC, *TLm, Stull invert oil.

Bioassays were conducted to determine the toxicity of 14 herbicides to bluegill sunfish. 24 and 48 hour TLm's were calculated for endothal, TD-191, TD-47, TD-266, diphenamid, emid, fenac, dichlobenil, CIPC, dalapon, diquat, amitrole, sterox and stull invert oil. (Sjolseth-Washington)
W70-09435

EFFECT OF TEMPERATURE SHOCK ON THE TEMPERATURE RESISTANCE OF POIKILOTHERM AQUATIC ANIMALS. EXPERIMENTS ON THE PROBLEM OF HEAT AND COLD-HARDENING IN ANIMALS (GERMAN),
Kiel Univ. (West Germany).
Thies Basedow.
English summary. Internationale Revue der Gesamten Hydrobiologie, Vol 54, No 5, p 765-789, 1969. 64 ref, 15 tab, 16 fig.

Descriptors: *Thermal stress, Environmental effects, *Resistance, Laboratory tests, *Acclimatization, Water pollution effects, Fish behavior, *Fish physiology, *Cold resistance, Water, *Heat resistance, Heat treatment, Eels, Mollusks, Invertebrates.
Identifiers: *Temperature effects, Temperature resistance, *Adaptation.

After a sublethal heat shock the heat resistance of the fishes Idus idus and Xiphophorus helleri and the newt Triturus vulgaris undergoes a slight but statistically significant increase for a short time. The heat resistance of IDUS idus equally rises after more moderate, but longer lasting heat shocks. After a shock-transfer and maintenance in extremely high temperatures the three fish-species examined do not show a 'heat-hardening' discernible from the heat-adaptation. Sublethal heat shock and shock-transfer in extremely high temperatures have the same effect on the heat resistance of Idus idus. In the biological range of temperature of Idus idus and Anguilla vulgaris the rate of heat-adaptation increases with temperature. The results on the three invertebrates examined, Dinophilus gyrociliatus, Dreissena polymorpha, and Laomedea loveni, do not make necessary a distinction between a heat-hardening and a heat-adaptation. The problem of hardening is discussed in several aspects. The results can be interpreted as a resistance adaptation. (Sjolseth-Washington)
W70-09436

ALGAL CANCER AND CAUSAL SUBSTANCES IN WASTES FROM THE COAL CHEMICAL INDUSTRY,
Kyushu Univ., Fukuoka (Japan). Dept. of Fisheries Chemistry.
S. Ishio, T. Yano, and R. Nakagana.
Presented at the 5th International Water Pollution Research Conference, held in San Francisco, July-August 1970. 8 p, 13 ref, 7 fig, 1 tab.

Descriptors: *Public health, Foods, Water pollution effects, *Water pollution sources, Chemical wastes, Industrial wastes, Laboratory tests, Bottom sediments, Chromatography, Analytical techniques, Plant pathology, Plant growth regulators, *Plant disease.
Identifiers: *Algal cancer, *Porphyra tenera, *Benzanthrone, *Carcinogenic compound, Coal chemical industry.

Carcinogenic compounds which induce the algal cancer of Porphyra tenera were extracted with acetone from the bed mud polluted by wastes from the coal chemical industry. The extracts were separated in ether solution into bases, acids and neutrals. The most intensive carcinogenic potency was found in the neutral compounds. The neutrals gave two carcinogenic compounds. One was confirmed to be benzanthrone, another was a new hydrocarbon with the molecular formula C2 5H14. Benzanthrone brought about the algal cancer to all leaves of Porphyra tenera within 40 days at 10 deg C in a concentration as low as 0.2 ppm. (Sjolseth-Washington)
W70-09437

ANIONIC AND NONIONIC SURFACTANT SORPTION AND DEGRADATION BY ALGAE CULTURES,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
Ernst M. Davis, and Earnest F. Gloyna.
Journal of the American Oil Chemists' Society, Vol 46, No 11, p 604-608, 1969. 9 ref, 2 fig, 3 tab. NSF Grant NSF-GU-1963.

Descriptors: *Linear alkylate sulfonates, *Surfactants, Water pollution sources, *Detergents, *Degradation (Decomposition), Cyanophyta, Chlorophyta, *Algae, Sorption, Waste water treatment, Cultures, Chlorella, Water pollution effects.
Identifiers: *Alkyl poly ethoxylate, *Alkyl phenol polyethoxylate, Anionic surfactants, Nonionic surfactants, Infrared spectra.

Degradation of three surfactants has been determined by organic extraction procedures and infrared spectroscopy. Axenic cultures of five species of blue-green algae and three species of green algae which are common to waste stabilization ponds were test organisms. Analytical data are shown comparing the effects produced by the algae cultures and a heterogeneous microcosm. Linear alkyl

lfonate was the anionic surfactant compound sted. An alkyl polyethoxylate and an alkyl phenol olyethoxylate were the nonionic test surfactants. orption of the compounds by the algae usually was llowed by release and degradation of up to 99% some of the component parts of the surfactant olecule. (Sjolseth-Washington)
70-09438

D. Waste Treatment Processes

RITISH WATER POLLUTION CONTROL,
amuel H. Jenkins.
nviron Sci Technol, Vol 4, No 3, p 204-209, Mar 970. 6 p, 5 fig.

escriptors: Water pollution, *Water pollution ontrol, Water quality, Water pollution treatment, Vater quality control, Water reuse, Municipal astes, *Sewage treatment, Water treatment, Vater works, Sewage works, Waste water treatent, Waste water (Pollution), Inspection, *Indusial waste treatment, Sewage effluents, Foreign ountries.
lentifiers: Water quality standards, Municipal ewers, *Great Britain.

t a time when most industrial nations are seeking control pollution of inland waters by stricter laws r new legislation, Britain can claim that many of s rivers are now in better condition than they were 0 yr ago. Regional pollution control authorities, oint treatment of industrial and municipal waste vater, and an effective inspectorate system are key eatures of Britain's pollution control program. Manufacturers have the right to discharge effluents nto public sewers. Municipalities owning the ewers have the power to set conditions for the ischarges. River authorities are responsible for ontrolling pollution of surface and underground vaters. The fact that effluents from municipal ewage treatment plants must meet requirements of he river authorities, and the law that requires muicipalities to receive industrial waste have compelled local authorities to control discharge of hese wastes to public sewers. To ensure that manufacturers comply with the legal consent received rom the municipalities, local authorities maintain an inspectorate service. Inspectors have powers of entry to take effluent samples. (USBR)
W70-09041

A MODEL OF WATER QUALITY MANAGEMENT UNDER UNCERTAINTY,
Chicago Univ., Ill.
For primary bibliographic entry see Field 06A.
W70-09109

EFFECTIVE PHOSPHORUS REMOVAL BY THE ADDITION OF ALUM TO THE ACTIVATED SLUDGE PROCESS,
Metropolitan Sanitary District of Greater Chicago, Ill.
David R. Zenz, and Joseph R. Pivnicka.
Paper presented at the 24th Annual Purdue Industrial Wastes Conference, May 6-8, 1969. 59 p, 34 fig, 4 tab, 21 ref.

Descriptors: *Phosphorus, *Phosphates, *Phosphorus compounds, *Chemical precipitation, *Chemical degradation, *Biological treatment, *Biodegradation, *Biochemistry, *Biochemical oxygen demand, *Waste water treatment, *Water pollution control, *Eutrophication, *Algal control, *Tertiary treatment, Suspended load, Pilot plants, Activated sludge, Treatment facilities.
Identifiers: *Phosphorus removal, *Alum, *Aluminum sulfate, *Activated sludge process, Hanover treatment plant.

The objective of this experimental research was to evaluate, under actual waste water treatment plant operating conditions, a combined chemical-biological process capable of producing an effluent low in phosphorus, BOD and suspended solids. Tests were conducted at the Hanover Park Water Reclamation Plant in Cook County, Illinois. The plant consists of a 2 mgd conventional activated sludge facility and a tertiary facility capable of treating the entire flow from the secondary facility. The secondary plant was separated into two distinct systems for the tests. Alum was added to the influent of the aeration tank of one system by a feed pump. Effluent samples, taken automatically as 24-hour composites, were analyzed for BOD, SS, VS, per cent total solids, per cent volatile solids, alkalinity, S.V.I and NH3-N. An Autoanalyzer was used for phosphorus determinations. It was found that the process can produce effluent phosphorus concentrations of 2.30 mg/l (total P) and 0.83 mg/l (soluble P) at a Al:Total P Ratio (molar basis) of 1.54 and a Al:Soluble P Ratio of 1.85. This is 83 and 93 per cent removal, respectively. Bound phosphorus was not released during anaerobic digestion. Additions of large amounts of alum did not adversely affect BOD removal efficiency, but removed higher microbial life forms in the mixed liquor. The suspended solids increased at an alum concentration of 252 mg/l. Waste sludge increased, and S.V.I decreased. Alum did not upset the anaerobic biological treatment process. (Poertner)
W70-09186

REDUCING WASTE ACTIVATED SLUDGE VOLUME BY ANEROBIOSIS,
San Jose-Santa Clara Water Pollution Control Plant, San Jose, Calif.
Edward R. Becker.
Report 1968. 78 p, 26 fig, 5 tab, 31 ref. FWPCA Demonstration Grant WPC-129-01.

Descriptors: *Anaerobic digestion, *Anaerobic conditions, *Anaerobic bacteria, *Activated sludge, *Aeration, *Anaerobic treatment, *Biological treatment, *Sewage bacteria, *Sewage treatment, *Sludge treatment, *Waste water treatment, Solids contact process, Pilot plants.
Identifiers: *Anaerobiosis, *Waste activated sludge, Sludge volume reduction.

Description of a pilot plant demonstration of the feasibility of incorporating anaerobiosis in the activated sludge waste water treatment process to compact and reduce the volume of waste activated sludge. The process is viewed as a method that might be economically attractive to many communities that employ activated sludge treatment methods. A 12 per cent reduction in total waste sludge volume and a 22 per cent reduction in weight was exhibited. Possibilities of reducing pollution problems from effluents of secondary treatment plants by decreasing nitrites, nitrates, and phosphates were demonstrated. A pilot plant was designed and constructed to simulate the operating conditions of the San Jose - Santa Clara Water Pollution Control Plant. Two physically identical secondary treatment units were provided, except that an anaerobic holding tank was added to one unit. The major plant primary effluent was used as a common influent to both units. Settled activated sludge withdrawn from the final clarifier was held for detention periods of 0, 4, 6, 8, and 12 hours in the anaerobic holding tank. Samples of waste activated sludge were withdrawn regularly from both units and analyzed daily to evaluate the effectiveness of anaerobiosis in reducing waste sludge volumes. The optimum period of anaerobiosis developed with a four-hour sludge-detention period. (Poertner)
W70-09187

ODOR CONTROL METHODS, EXPERIMENTATION AND APPLICATION,
Los Angeles County Sanitation District, Calif.
Jay G. Kremer.
Report, 1969. 71 p, 36 fig, 13 tab, 79 ref.

Descriptors: *Odor, *Air pollution effects, *Organoleptic properties, *Waste water treatment, *Activated carbon, *Activated sludge, Pilot plants, Hydrogen sulfide, Sulfur, Cost comparisons.
Identifiers: *Odor control, *Odor evaluation, Activated sludge scrubber, Turbulent contact absorber scrubber.

Describes the field and laboratory investigations conducted by the County of Los Angeles Sanitation Districts to develop methods, procedures and equipment for odor control of air flows from wastewater treatment plants. The objectives of the project were to: develop means to quantitatively evaluate odor concentrations; formulate systems for removing odors; evaluate the systems for practicality and effectiveness; and determine costs of odor removal. A literature search revealed scant knowledge of practical methods of odor control. A method patterned after ASTM D1391 was found effective and of sufficient accuracy for making quantitative evaluations of odors. A special odor evaluation room was constructed and equipped for odor evaluations by male and female students from a nearby college. Pilot plants were constructed and tested to evaluate various methods of removing odors from air flows of waste water. These included: a conventional activated sludge scrubber; a packed-tower turbulent contact liquid scrubber using activated sludge and various chemicals; and activated carbon absorbtion. Cost comparisons, advantages, and capacities are described for the above methods and for fume incineration. A successful application of activated carbon for odor removal was made at a waste water pumping station. (Poertner)
W70-09190

USES OF WASTE HEAT,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03C.
W70-09193

UNIVERSITY ROLE IN ASTRONAUT LIFE SUPPORT SYSTEMS: WATER RECOVERY SYSTEMS,
Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
John R. Tole.
National Aeronautics and Space Administration Contractor Report NASA CR-1629, June 1970. 55 p, 11 fig, 3 tab, 76 ref. NASA Contract No NGR-22-009-312.

Descriptors: *Water reuse, *Reclaimed water, *Water quality, *Monitoring, *Research facilities, Grants, Universities, Research and development, Contracts, Desalination apparatus, Distillation, Systems analysis, Waste water treatment.
Identifiers: *National Aeronautics and Space Administration, Life support systems.

One of the vital spacecraft life support systems is that used to supply water. Short duration missions allow storage of sufficient water, but for long duration missions, the weight of such a supply becomes unacceptable. This paper reviews techniques for recovering potable drinking and wash water from spacecraft waste water. Emphasis is placed on problem areas which exist in such recovery and which may be suitable topics for university type research. Areas covered include nature of waste waters which might be processed, potability requirements and monitoring techniques, existing and possible future recovery techniques, means of selecting a suitable technique from a number of different types, and problems of a fringe nature such as means of monitoring body mass to keep track of human water exchange. An attempt is made to stimulate new ideas based on present knowledge. (Knapp-USGS)
W70-09236

FINAL REPORT ON REVERSE OSMOSIS MEMBRANES CONTAINING GRAPHITIC OXIDE,
Westinghouse Electric Corp., Pittsburgh, Pa.
For primary bibliographic entry see Field 03A.
W70-09245

HYDROCASTING REVERSE OSMOSIS MEMBRANES,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 03A.
W70-09246

IN-PLANT WASTE REDUCTION,
Humble Oil and Refining Co., Baytown, Tex.
Sidney O. Brady.
Journal of the Water Pollution Control Federation, Vol 41, No 8, p 1516-1523, August 1969. 4 fig.

Descriptors: *Industrial wastes, *Oil wastes, *Waste water disposal, *Waste disposal, *Reduction, *Waste water treatment, Disposal, Chemicals, Operations.
Identifiers: *Process modification, *Refinery, Petroleum wastes.

In-plant waste reduction covers a multitude of practices many of which are preventive in nature. These practices play an important role in reducing the overall waste discharge from an industry, but in many areas probably are not considered as part of the waste control effort. Five preventative measures are discussed: (1) design, (2) process modification, (3) recovery and utilization, (4) local pretreatment or disposal, (5) operation control. Each measure is discussed from the petroleum industries viewpoint. Engineering design considerations commonly used are (a) separate drainage and sewer systems, (b) segration of waste water streams, and (c) water conservation. Design modifications that effect waste control and that may be considered as preventative measures are process selection and process and chemical losses. A special type of process design which contributes to economical waste reduction is that of waste plants to simple collection and sale of the chemicals. Several examples are given of local pretreatment or disposal which is performed in-plant. The dilemma confronting those agencies concerned with making a pollution loading charge versus raw material consumed is presented. The vast number of plants is different products, processes, etc., make this type of comparison impossible. (Hancuff-Texas)
W70-09316

FILTRATION OF WASTE PLANT EFFLUENTS,
Wayne State Univ., Detroit, Mich.
Henry A. Dirasian.
Water and Sewage Works, Vol 117, No 3, p 84-88, March 1970. 4 fig, 4 tab, 9 ref.

Descriptors: *Waste Water treatment, *Materials, *Effluents, *Filtration, *Diatomaceous-earth, Activated carbon, Flyash, Biochemical oxygen demand, Chemical oxygen demand.
Identifiers: Suspended solids.

The combination of filtration characteristics of diatomaceous earth and adsorptive properties of activated carbon provided efficient removal of contaminants from waste water treatment plant effluents. The study was broken down into 3 phases: (1) diatomaceous earth alone was used as the filtering medium, (2) diatomaceous earth was used with varying concentrations of activated carbon and, (3) flyash alone constituted the filtering medium. The results of this feasibility study have verified the hypothesis that additional treatment of waste treatment plant effluents is possible using filter aids with pressure type filters. Best results were obtained using diatomaceous earth as the filtering medium with the inclusion of activated carbon. Results with flyash filter were not very impressive. It appears desirable to continue studies on the flyash filter since it is believed that properly graded and washed flyash could yield BOD and SS removals substantially higher than those attained. Since the study was a feasibility type, no attempt was made to determine the most efficient methods of operation nor any detailed cost analysis. (Shankar-Texas)
W70-09317

POLYMER PLUS MAGNETIC FIELD USED TO TREAT PARAMAGNETIC SLURRIES,
Jones and Laughlin Steel Corp., Pittsburgh, Pa.
D. F. Peck, and T. J. McBride.
Water and Sewage Works, Vol 116, No 11, November 1969. 9 fig.

Descriptors: *Waste water treatment, *Industrial wastes, Waste water, *Flocculation, Magnetic studies, *Slurries sedimentation.
Identifiers: *Polymer, Paramagnetics, Settling rate, Oxygen furnance, Suspended solids, Magnetic-polymer process.

Certain aqueous steel mill wastes have proven difficult to treat from the standpoint of color and solids removal. Conventional treatment facilities require low over-flow rates and sizeable space requirements. The development of a new process which improves solids separation from the paramagnetic waste slurries is discussed. The process consists of (1) treatment with an anionic polymer and (2) controlled exposure to a magnetic field prior to settling in conventional equipment. Settling rates by the magnetic-polymer process have been shown to be higher than any other treatment for similar wastes. The polymer which gave the best results when used in combination with a magnet was a high molecular weight water soluble anaionic material of the polyacrylamide class. A brief account of proposed mechanics of double floccing for paramagnetic slurries is presented. A summary of advantages of the magnetic-polymer flocculation process as applied to paramagnetic slurries is given. The combination process results in a high degree of apparent color removal. (Shankar-Texas)
W70-09318

ADVANCES IN HANDLING GAS CHLORINE,
Capitol Controls Co., Inc., Colmar, Pa.
Gerald F. Connell, and John J. Fetch.
Journal of the Water Pollution Control Federation, Vol 41, No 8, p 1505-1515, August 1969. 7 fig, 10 ref.

Descriptors: *Chlorine, *Chlorination, *Materials, *Safety, *Plastics, Gases, Oxidation, Temperature, Disinfection, Waste water treatment.
Identifiers: *All-vacuum chlorination system, *Chemical handling.

The method of gas chlorination in comparison with powder and liquid techniques is more advantageous than the other disinfection techniques because of economics and safety. An improvement to the vacuum operated solution feed system is presented in the form of the all-vacuum method of chlorination whereby the chlorinator is mounted directly on top of the chlorine cylinder. Several chlorine myths are discussed such as: chlorine explosions or burning. The element chlorine is non-explosive, will not burn, and is heavier than air. The economics and safety of liquid bleach versus gaseous chlorine are discussed, and it is shown that gas is the most economical technique for feeding chlorine because it requires less material and has least cost per pound. Other misunderstood facts about chlorination are also discussed such as 'frozen' chlorine lines. Internal and external materials of construction are discussed as well as other safety aspects. (Hancuff-Texas)
W70-09319

BAFFLED BIOLOGICAL BASIS FOR TREATING POULTRY PLANT WASTES,
Syracuse Univ., N.Y.
Nelson L. Nemerow.
Journal of the Water Pollution Control Federation, Vol 41, No 9, p 1602-1612, September 1969. 8 fig, 9 tab.

Descriptors: *Biological treatment, *Oxidation, Lagoons, *Baffles, *Waste water treatment, *Poultry, Industrial wastes, Lagoons, Ponds, Photosynthesis, Costs, Efficiency, Biochemical oxygen demand, Algae, Sedimentation, Settling basins.
Identifiers: *Chickens, Food wastes, Poultry wastes.

A poultry plant in Millsborough, Delaware, processed 10,000 chickens per hour with a waste water of 40,000 gph, and an effluent of 2,500 lb BOD5/day at an average BOD of 630 mg/l. Because the area is commercially and recreationally of great value a program was initiated to reduce the waste water concentration at a maximum cost of $100,000. Adequate screening followed by a two-stage oxidation pond plant utilizing over and under contact baffles in the first stage followed by chlorination provided a 85 to 95% BOD reductions. The first stage consists of a baffled high-rate deep pond. The second state is a shallow synthetic basin. Loadings of over 200 lb/day/acre resulted in high efficiency and coliform counts of less than 10/1000 ml. The final cost was $90,000. (Hancuff-Texas)
W70-09320

EFFECT OF RECIRCULATION ON DEEP TRICKLING FILTER PERFORMANCE,
Regional Inst. of Tech., Jamshedpur (India).
V. Hanuamanulu.
Journal of the Water Pollution Control Federation, Vol 41, No 10, p 1803-1806, October 1969. 2 fig, 2 tab, 4 ref.

Descriptors: *Trickling filters, *Sewage treatment, *Waste water treatment, *Performance, Efficiencies, Biochemical oxygen demand, Filters.
Identifiers: *Secondary treatment, *Recirculation, *Loadings.

Three trickling filters of 12 foot media depth at Dadar-Bombay Wastewater treatment plant were studied to determine the effect of recirculation on efficiency. One was provided with recirculation while the other two were without it. The filter with recirculation consisted of closed filter with artificial ventilation by means of blowers. The recirculation ratio was 1, the flow was 1.59 MGD, and the hydraulic loading was 23.6 MGD/acre. The 2 filters without recirculation were loaded at 14.3 MGD/acre and handled 2.4 MGD. Both types of filters were working under the same conditions of media depth, media characteristics, waste water characteristics, temperature and organic loading. The filter with recirculation achieved an efficiency of 91% while those without recirculation attained only 52%. Recirculation resulted in distributing the organic loading almost uniformly throughout the depth of the filter. The effect of recirculation will be predominant if the strength of the waste water is high. (Hancuff-Texas)
W70-09321

EUROPEAN WASTE WATER MANAGEMENT AND RESEARCH,
Department of National Health and Welfare, Edmonton (Alberta). Public Health Engineering Div.
Charles P. Fisher, and Hugh R. Eisenhauer.
Water and Pollution Control, Vol 107, No 12, p 26-28, December 1969.

Descriptors: *Industrial wastes, Economics, *Waste water (Pollution), *Waste water treatment, *Management, *Research facilities, *Pollution abatement, Sewage treatment.
Identifiers: Penalties.

A summary of visits to certain outstanding waste water research establishments is presented and some insight into European waste water management practices is gained. Antipollution laws in Italy are lax and apply only to the Fisheries without and references to human health. Rome draws it's drinking water supply from a recreational lake where sewage is directly discharged. Czekoslovakia appears to be fairly advanced in waste water management. A brief sketch of the projects under research in a hydraulic research institute at Bratislava is given. Vienna, a city with a population of 2 million, does not have sewage purification facilities but a plant for the city is presently under design. Germany was found to be the forefront of waste water

agement. Problems of management in Ger-
y led to the creation of Emscher Association by
cial Act passed by the Prussian Diet in 1904.
the industries and municipalities are required
aw to join the Association. In Holland waste
r management seems to be at its highest level.
ankar-Texas)
0-09322

TTLE SKIN TANNERY WASTES TREAT-
NT IN A COMPLETELY MIXED AC-
ATED SLUDGE PILOT PLANT,
lan (Edward C.), Inc., Portland, Maine; and
ne Univ., Orono.
ert E. Hunter, and Otis T. Sproul.
rnal of the Water Pollution Control Federation,
41, No 10, p 1716-1725, October 1969. 3 fig, 4
4 ref.

criptors: *Waste water treatment, *Activated
ge, *Pilot plant, Industrial wastes, Operations,
ciencies, Performance, Toxicity.
ntifiers: *Tannery Waste, *Cattle skin waste,
ather waste, Chrome wastes, Waste charac-
stics, Completely mixed activated sludge, Load-

treatment of waste water from a cattle skin
nery process always has been considered
ause of the high pollutional characteristics of
waste the potential toxic chemicals used in the
cess and the wide variety of both the quantity
characteristics of the wastes over the process
. Treatment criteria were developed for a
ome-tanning waste through which 90% organic
noval was obtained. A completely mixed ac-
ted sludge pilot plant with 3,000 gallons/day
acity was constructed and operated for 27 days
arying loadings. The pilot plant consisted of the
owing basic units. (1) collection troughs and
fall mixing units, (2) influent pump, (3) splitter
k, (4) a primary sedimentation tank, (5) aera-
n tank, (6) secondary sedimentation tank, (7)
lift solids return and (8) blower. The BOD load-
to the pilot plant varied from 42.5 to 80.9
day. Suspended solids loading varied from 47.8
103.6 lb/day. Hydraulic loadings on the primary
imentation tank varied from 216 to 440 gpd/ft
The primary sedimentation unit removed ap-
ximately 40% of the influent BOD and about 50
60% of the suspended solids. BOD loading to the
ation tank ranged from 127 to 272 lb/day/1000
ft. of aeration capacity. The BOD to mixed
uor suspended solids loading varied from 22 to
lb. Aeration times varied from 10.6 to 19.0
urs. The data were adapted to design criteria for
nt treating 10,000 pounds of organics per day
m the tannery and a population of 2,500. (Han-
ff-Texas)
70-09324

STATEMENT ON PHOSPHORUS,
innesota Univ., Minneapolis.
seph Shapiro.
urnal of the Water Pollution Control Federation,
l 42, No 5, Part 1, Page 772-775, May 1970. 4
f.

escriptors: *Phosphorus, *Detergents, *Tertiary
eatment, *Eutrophication, Waste water treat-
ent, Algae, Effluents, Nutrients, Sewage treat-
ent, Lakes.

paper by L. E. Kuentzel published in the October
969 issue of the JWPCF is discussed and evalu-
ed by Shapiro. The discussion is basically a refu-
tion of arguments presented by Kuentzel in his
allenging the efficacy of phosphorus removal for
trophication control. Several works cited, previ-
us to Kuentzel's, supports the fact that reduction
phorphorus in effluents through curtailed use of
etergents or advance waste water treatment will
duce eutrophication of lakes significantly and
ill allow those already severely affected to begin
eir recovery through natural processes. (Han-
uff-Texas)
70-09325

FLEXIBILITY KEY TO DESIGN OF MACHINING PLANT'S TREATMENT FACILITIES,
Chrysler Corp., Detroit, Mich.
A. R. Balden.
Water and Sewage Works, Vol 117, No 3, March 1970. 6 fig, 2 tab.

Descriptors: *Oil, *Waste Water Treatment, *Industrial wastes, *Flexibility, *Emulsion, Sedimentation, Waste treatment, Lagoons, Cost, Flocculations mixing, Settling basins, Skimming.
Identifiers: *Machinery Plant, *Air flotation, Grit removal, Settled Solid, Acidification.

The waste treatment in a Toledo machining plant and the difficulty encountered in treating some of the contaminants such as oil, emulsion cleaners, etc. is explained. The waste water from the factory flows by gravity to a pump and a grit remover screens out all the large solids. The water is transferred to 3 primary clarifiers by a float activated pump. The tanks are provided with drum skimmers for oil removal and Bottom Scrapers move the settled solids to a recess in the floor. After settled solids are floated oils, have been removed, the blended waste is tested to determine whether acidification will remove more oil. The blended water is treated with ammonium sulfate and the pH is adjusted. It is then treated with Air Flotation. Scum is accumulated in a sump from which it is periodically pumped and hauled to an oil reclamation site. The final treatment prior to disposal is sedimentation. The drum skimmers were later abandoned in favor of weirs, since it was noticed that skimmers led to the production of an invert emulsion which resulted in a serious interference in the efficiency of oil removal. Research is underway to increase the amount of recoverable and reusable oil from the treated waste. (Shankar-Texas)
W70-09326

CHARACTERISTICS OF WASTEWATER AT DELHI,
Pahlavi Univ., Shiraz (Iran).
Jatinder K. Bewtra.
Journal of the Water Pollution Control Federation, Vol 41, No 2, p 208-221, February 1969. 6 fig, 10 tab, 12 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Statistics, *Corrleation analysis, *Treatment facility, Biochemical oxygen demand, Probability, Kinetics.
Identifiers: *Rate constant, *Grit removal, *Delhi, Suspended solids, Loading.

Characteristics of waste water from different stages of treatment in Okhla Sewage Works, one of the largest plants in Asia, were studied for three years. Investigated were the characteristics of grit, suspended solids, rate constants for BOD at different temperatures and correlations between waste water characteristics like BOD, volatile and total suspended solids, and volatile and total solids on evaporation. Tests showed that future grit chamber design should allow removal of 0.1 mm size particles of 2.45 specific gravity at a flow of 0.49 ft/sec, mean BOD rate constant values at 20 deg were 0.186, 0.164, and 0.119/days for raw, settled and treated waste water respectively. 60-75% of suspended solids and 45 to 60% BOD were removed from the raw waste water. (Hancuff-Texas)
W70-09327

DIGESTED SLUDGE DISPOSAL ON CROP LAND,
Illinois Univ., Urbana; and Metropolitan Sanitary District of Greater Chicago, Ill.
Thomas B. Hinesly, and Ben Sosewitz.
Journal of the Water Pollution Control Federation, Vol 41, No 5, p 822-830, May 1969. 3 fig, 4 tab.

Descriptors: *Sludge disposal, *Crops, *Agriculture, *Irrigation, *Fertilizers, Stabilization, Digestion, Sludge, Sludge digestion, Nutrients, Trace elements, Odors, Infiltration.
Identifiers: Chicago (Illinois).

After an exhausted study to determine the best solids disposal solution, the Metropolitan Sanitary District of Greater Chicago concluded that digestion followed by land disposal could cope with Chicago's 1000 tons/day of sludge successfully at a cost of $20-$23/ton. Research designed to determine groundwater contamination, the effect of heavy metals and crop irrigation parameters was conducted. At the Northeast Agromony Research Center digested sludge was applied by furrow irrigation at weekly intervals on crop land planted with corn and kenaf. The rates were 1, 0.5, 0.25, and 0 inches for a total of 6 weeks. Average corn yield was 111.9, 114.2, 96.2, and 66.3 bushels per acre, respectively. While all the results are not in for the first years research and demonstration projects on the 8 acre and 30 acre test plots some observations can be summarized. (1) The crops responded favorably to digested sludge. (2) Offensive odors have not been a problem. (3) Flys were never a problem. (4) Furrow irrigation is preferred to sprinkler irrigation. (5) Application of nitrogen in amounts greater than those needed for crop reduction will increase nitrate level in drainage water. (Hancuff-Texas)
W70-09328

DEGRADATION OF WASTE WATER ORGANICS IN SOIL,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
For primary bibliographic entry see Field 05E.
W70-09329

BOD AND COLOR REMOVAL FROM KRAFT MILL WASTES,
Nova Scotia Technical Coll., Halifax.
D. Thirumurthi, G. McKenna, and H. G. Bown.
Water and Sewage Works, Vol 116, No 12, p 491-494, December 1969. 4 fig, 3 tab, 9 ref.

Descriptors: *Biochemical oxygen demand, *Color, *Industrial wastes, *Pulp and paper industry, *Aeration, Coagulation, Laboratory tests, Lagoons, Waste water treatment, Mills.
Identifiers: Alum.

The BOD and color removal characteristics from a kraft mill waste by parallel treatment with alum coagulation and a laboratory model aerated lagoon were investigated. Aerated lagoon treatment was confirmed to be an effective system for BOD removal from Kraft pulp mill wastes. However, aeration did not accomplish any significant color reduction. Alum coagulation was efficient in color removal from Kraft mill wastes. At a pH of 6, an alum dose of 0.9 mg/l removed 92.8% of color causing compounds after 5 minutes of settling. However, a bulky sludge (20% of initial waste volume) resulting from sedimentation was a potential nuisance. Under the test conditions, alum coagulation did not render a significant BOD removal. A combination of series, parallel or series-parallel flow systems with alum coagulation and aerated lagoon treatment should be investigated before designing proto-type pollution control facilities for Kraft pulp mills. (Aguirre-Texas)
W70-09330

AERATED LAGOONS TREAT SECONDARY EFFLUENT,
Van-Note-Harvey Associates, Princeton, N. J.
James C. Pierce, Jr.
Water and Sewage Works, Vol 117, No 5, p 162-164, May 1970. 5 fig.

Descriptors: *Activated sludge, *Aeration, *Effluents, *Tertiary treatment, *Lagoons, New Jersey, Waste water treatment.
Identifiers: *Aerated lagoons, *Contact stabilization.

The rapidly expanding population of East Windsor Township, New Jersey required an expansion of their 0.5 MGD contact stabilization plant built in 1966. Plant effluent discharged into the Millstone River, a sluggish stream with low flows in the late

summer. The New Jersey Department of Health promulgated stream standards requiring BOD removals of 90% at all times, including any four hour period that peak flows could come through the plant. One of the disadvantages of the existing treatment plant was the discharge of light, flocculant suspended solids over the settling tank weir during peak flow periods of the day. An additional 0.5 MGD contact stabilization plant was elected for the expansion. Both secondary plants were followed by an aerated lagoon for tertiary treatment. Lagoon aeration was accomplished with an Air-Aqua System. The tertiary lagoon was sized for 4 MGD to provide capacity for future additions. The lagoon did an effective job of handling BOD's and suspended solids discharges of up to 80 mg/l during periods of peak flows. Lagoon effluent contained 12 to 15 mg/l BOD and suspended solids. There were no settleable solids discharged from the lagoon. (Aguirre-Texas)
W70-09331

RESPONSE OF DAIRY WASTE ACTIVATED SLUDGE TO EXPERIMENTAL CONDITIONS AFFECTING pH AND DISSOLVED OXYGEN CONCENTRATION,
Agricultural Univ., Wageningen (Netherlands). Lab. of Microbiology.
A. D. Adamse.
Water Research, Vol 2, p 703-713, 1968. 8 fig, 2 tab, 10 ref.

Descriptors: *Activated sludge, *Dairy industry, *Dissolved oxygen, *Hydrogen ion concentration, Carbohydrates, Industrial wastes, Laboratory tests, Oxygen requirements, Waste water treatment.

When activated sludge was fed a normal amount of artificial dairy waste, a sharp drop of pH and dissolved oxygen (DO) was observed immediately after feeding, due to the ready dissimilation of the carbohydrate fraction of the substrate. Decomposition of the protein fraction started later, proceeded at a much lower rate, and was accompanied by a slight fall of pH and DO for a more prolonged period of time. The drop of pH during dissimilation of the carbohydrate fraction was caused by a transitory occurrence of acid intermediates in suspension. This was assumed to be due to the fact that, in spite of very vigorous aeration, the oxygen absorption rate was unable to meet the increased demand for oxygen and therefore the oxygen absorption rate became a limiting factor in the oxidation of the carbohydrate fraction of the substrate. The difference found between the dissimilation rate of the carbohydrate fraction and that of the protein fraction caused a discrepancy between the potential and actual C/N ratios of the substrate. Analyses of the acid intermediates showed that acetic acid was accumulated in the activated sludge suspension when DO was present, whereas lactic acid was found when DO was absent. (Aguirre-Texas)
W70-09332

THE SEASONAL PERFORMANCE AND THE PATTERNS OF CHEMICAL AND BIOLOGICAL EVENTS IN SEWAGE LAGOONS,
Arizona State Univ., Tempe. Coll. of Engineering Sciences.
John W. Klock.
Engineering Research Center Report, August 1968. 128 p, 66 fig, 13 tab, 85 ref.

Descriptors: *Biological treatment, *Chemical properties, *Effects, *Performance, *Seasonal, *Sewage lagoons, Lagoons, Oxidation lagoons, Ponds, Waste water treatment.

Two experimental lagoons were constructed to study the biochemistry of sewage lagoons and by so doing improve their operation and design for the purpose of economically producing higher quality effluents suitable for reuse in the semiarid Southwest. The program consisted of field studies of the chemical and biological characteristics and cyclic patterns of sequential phase sewage lagoons. Particular interest was devoted to the winter recession and spring recovery and the fate of coliform organisms. The seasonal range of the basic environmental factors encountered in these field studies was (1) incident light intensity (total), 185 to 775 gcal/ (sq cm)-day; (2) air temperature, -7 to 44.5C; (3) influent waste water temperature, 22 to 32C; (4) ambient waste water temperature, 3 to 28C. The Eh-pH diagram was extensively used in describing the sequence of chemical and biological events that constitute the conversion of raw undiluted sewage to, first, a biologically active and fertilized 'treated waste' and secondly, to a relatively stable water. (See also W70-09334) (Aguirre-Texas)
W70-09333

THERMAL ENERGY CONSERVATION AND SEQUENTIAL BIOLOGICAL PROCESSING APPLIED TO SEWAGE LAGOON DESIGN,
Arizona State Univ., Tempe. Coll. of Engineering Sciences.
John W. Klock.
Engineering Research Center Report, October 1968. 28 p, 12 fig, 4 tab, 5 ref.

Descriptors: *Biological treatment, *Conservation, *Design, *Heat budget, *Sewage lagoons, Lagoons, Oxidation lagoons, Ponds, Waste water treatment.
Identifiers: *Thermal energy conservation.

This study incorporated the following principles into a reliable and simply operated lagoon system: (a) thermal energy conservation, (b) sequential phase processing, and (c) utilization of thin plastic films to form channel barriers and heat transfer interfaces. The lagoon was designed on an 8-day flow-through-time with approximately one-half of this period in each of the first and second phases. Phase I was intended to be principally a bacterial culture and phase II was an algal culture followed by limited growth of crustaceans and aquatic insects. The two phases are superimposed to improve heat utilization and prevent premature algal growth and nutrient fixation. Lagoon performance was notable by its treatment uniformity throughout the year, ranging from a low of 75.8 in the fall to a high of 78.9% BOD removal in the spring. The lagoon was clean with minimal surface solids and no odors at any time. The phase I effluent was a clear liquor and the phase II effluent had a pale green of a dilute algal culture. Seasonal performance was evaluated with studies of suspended solids reduction, deposited solids accumulation, Eh-time and pH-time patterns, BOD and COD reductions, presence of H2S and molecular oxygen, and algal activity. (See also W70-09333) (Aguirre-Texas)
W70-09334

TREATMENT OF DAIRY MANURE BY LAGOONING,
Washington State Univ., Pullman.
Surinder K. Bhaghat, and Donald E. Proctor.
Journal of the Water Pollution Control Federation, Vol 41, No 5, p 785-795, May 1969. 9 fig, 7 tab, 6 ref.

Descriptors: *Waste water treatment, *Dairy industry, *Industrial wastes, *Lagoons, *Performance, *Pilot plants, Sewage treatment, Ponds, Biochemical oxygen demand, Anaerobic treatment, Aeration, Design, Nutrients.
Identifiers: *Anaerobic treatment, *Loadings, *Characteristics, *Feed lot wastes.

A series of anaerobic ponds were operated to treat dairy cattle feed lot wastes. Approximate dimensions are pond no. 2 100x50x4, pond no. 3, 150x60x3, and pond no. 4, 30,000 sq ft area and a depth of 3 feet. Tests were run on BOD, COD, and total dry solids, volatile solids, nutrients, pH, and temperature. The ponds operated anaerobically and were satisfactory as primary treatment. Removals were above 86% for loadings of 70lb volatile solids/day/1000 cu ft. The effluents from the lagoon required further treatment. The effluent from the anaerobic lagoon is potent and can be disposed of in either of two ways: (a) applied to t fields, and (b) given further anaerobic treatmer The effluent from the anaerobic lagoons o retains most of the nutrients present in the ra manure waste and thus has fertilizer value. If land not available for the disposal of the effluent fro the anaerobic lagoons, secondary treatment can b provided in the form of aerated lagoons, oxidatio ditches or an oxidation pond. The results of batch-type aerobic treatment indicated that an e fluent BOD of 20mg/l could be achieved by a 2 hour aeration period, when fed the 200mg/l BO effluent from the anaerobic ponds. (Hancuff-Te as)
W70-09335

CONTROL MECHANISMS OPERATIVE IN NATURAL MICROBIAL POPULATIO SELECTED FOR ITS ABILITY TO DEGRAD L-LYSINE, II. EFFECTS OF FRUCTOSE AN RIBOSE IN BATCH SYSTEMS,
Oklahoma State Univ., Stillwater. Bioengineerin Labs.
C. P. L. Grady, and A. F. Gaudy.
Applied Microbiology, Vol 18, No 5, p 785-78 November 1969. 2 fig, 2 tab, 12 ref.

Descriptors: *Activated sludge, *Carbohydrate *Control, *Effects, *Microbiology, Bacteri Chemical oxygen demand, Population.
Identifiers: Batch systems, Lysine.

A natural microbial population was acclimated t L-Lysine as the sole carbon source when ammon nitrogen was provided in the medium. Fructose e erted a slight retarding effect upon the metabol removal of lysine. The response was due to catabo ic repression of the inducible enzyme syste responsible for lysine degradation. Inhibition of a tivity of preformed enzymes played no part in th response. Ribose caused a slight increase in the ra of synthesis of lysine-degrading enzymes. Th response of the system to carbohydrates was function of the growth rate and of the rate production and accumulation of metabolic inte mediates. The compound allowing the faste growth exhibited the most severe repression. Glu cose supported relatively rapid growth (mu su m)% (0.45/hr) with the production of many inte mediates and, consequently, had a severe effe upon production of lysine-degrading enzyme Fructose, on the other hand, allowed the cells t grow with a (mu sub m) of only 0.17/hr with th excretion of few intermediates, and its effect wa rather mild. Growth on ribose was very slow (m sub m)% (0.04/hr). The major portion of ribos utilization which did occur in the mixed substrat system may have been directed to the synthesis RNA, which would account for the increased eff ciency of the cells and allow a faster rate of synthe sis of lysine-degrading enzymes. (See also W7 09337) (Aguirre-Texas)
W70-09336

CONTROL MECHANISMS OPERATIVE IN NATURAL MICROBIAL POPULATIO SELECTED FOR ITS ABILITY TO DEGRAD L-LYSINE, III. EFFECTS OF CAR BOHYDRATES IN CONTINUOUS-FLO SYSTEMS UNDER SHOCK LOAD CONDI TIONS,
Oklahoma State Univ., Stillwater. Bioengineerin Labs.
C. P. L. Grady, and A. F. Gaudy, Jr.
Applied Microbiology, Vol 18, No 5, p 790-79 November 1969. 5 fig, 1 tab, 11 ref.

Descriptors: *Carbohydrates, *Control, *Effects *Microbiology, Activated sludge, Bacteria, Chemi cal oxygen demand, Population.
Identifiers: *Continuous-flow, *Shock loads, L Lysine.

Two naturally selected microbial populations wer maintained under continuous-flow conditions wit glucose or magnesium growth-limiting. The reac tors were subjected to shock loads by changing th

luent substrate from L-Lysine to a mixture of L-sine and glucose, L-Lysine and fructose, or L-sine and ribose. During the subsequent transient te, the following parameters were examined: ne COD, carbohydrate COD, total COD, logical solids concentration, cell protein, enzy-tic capability (lysine-degrading enzymes), and rate of lysine removal. The carbohydrate was n removed from the influent and the same rameters were examined until a new steady state s established. In all cases, glucose and fructose used a significant repression of the synthesis of ine-degrading enzymes, resulting in a decrease in enzymatic capability of the cells. In the carbon-ited reactor, the faster the flow rate, the greater s the repression, whereas, in the magnesium-ited reactor, the slower the flow rate, the greater s the repression. The introduction of ribose into reactors caused an initial increase in lysine en-matic capability followed by a slight repression en ribose degradation started. (See also W70-336) (Aguirre-Texas)
70-09337

CONOMICS OF CANNERY WASTE TREAT-ENT,
ater Resources Engineers, Inc., Walnut Creek, lif.
E. Evenson, and G. T. Orlob.
ater and Sewage Works, Vol 117, No 3, p 18-19, arch 1970. 2 tab, 2 ref.

escriptors: *Industrial wastes, *Waste water eatment, *Canneries, *Dynamic programming, conomic efficiency, Biochemical oxygen demand OD), Solid wastes, Disposal, Efficiencies, Costs, ze, Screens, Aeration, Lagoons, Cost com-risons.
entifiers: *Unit processes, Algorithm, Sewer harges.

he use of a dynamic programming algorithm to in-stigate the economics of cannery waste treat-ent was demonstrated. The algorithm found the inimum cost-size-efficiency relationships for moving BOD from a cannery waste and treating id disposing of the solid wastes. The items con-dered were: in-plant waste treatment, municipal aste treatment systems, and one flow of waste ater, that, leaving the cannery. The in-plant treat-ent consisted of 5 components: screening, BOD emoval from liquid wastes, ultimate liquid isposal, solid waste treatment, and disposal. leven alternative unit processes comprised com-onent II. Vacuum filtration and solids oxidation ere the alternatives for component IV. Two alter-atives were considered for solids disposal: com-osting and landfill. The predominant treatment ystem that minimized cost consisted of screening, n aerated lagoon, and, depending on the size of he plant, either landfill or composting. An exam-le problem illustrated the use of these minimum ost-size-efficiency relationships. A sewer service harge was assumed in order to evaluate the alter-atives between treating the wastes in-plant, ischarging to a municipal system, or combinations f the two. (Galwardi-Texas)
V70-09338

TREATMENT AND SLUDGE DISPOSAL OF WASTES FROM THE MANUFACTURE OF AC-TIVATED CARBON,
Atlas Chemical Industries, Inc., Wilmington, Del.
S. A. LaRocca, W. W. Eckenfelder, Jr., and J. F. Malina, Jr.
Proceedings, Industrial Waste Conference, 23rd, p 1147-1165, May 1968. 12 fig, 5 tab.

Descriptors: *Industrial wastes, *Activated carbon, *Waste water treatment, *Sludge treatment, *Sludge disposal, Vacuum drying, Dewatering, Neutralization cyclones, Lime, Fly ash, Iron, Texas, Pilot plant, Laboratory tests, Performance.
Identifiers: *Suspended solids, Marshall (Texas), Iron precipitation, Liquid cyclones.

The manufacture of activated carbon from lignite yields a highly acidic waste water containing suspended fly ash and activated carbon particles. Pilot plant and laboratory studies were conducted to evaluate the most feasible means of suspended solids removal and sludge dewatering and disposal. Sedimentation and thickening, liquid cyclones, neutralization, centrifugation and vacuum filtration were considered. Neutralization of the waste to a pH of 8.0 to 8.5, eliminating post-precipitation of iron, was required to produce a stable and clear effluent. Product recovery of the activated carbon particles was decided upon. A complete waste treatment flow sheet for suspended solids removal and disposal was developed. Treatment for removal of the chemical precipitate consists of neutralizing the waste to 8.0 to 8.3 with lime, thickening with polyelectrolyte and sludge dewatering by vacuum filtration. Separate removal of fly ash consists of liquid cyclones in a closed loop recirculating system and dewatering by a horizontal belt vacuum filter. (Galwardi-Texas)
W70-09339

THE ORIGIN AND CHARACTERISTICS OF TOXIC WASTES, WITH PARTICULAR REFERENCE TO THE METAL INDUSTRIES,
Canning (W.) and Co. Ltd. (Gt. Brit.).
W. Lowe.
Water Pollution Control, Vol 69, No 3, p 270-280, 1970. 4 fig, 6 tab.

Descriptors: *Effluents, *Industrial wastes, Industries, Metals, Toxicity, *Waste water treatment.
Identifiers: *Metal finishing industry, *Toxic wastes.

This paper provides information on the wide range of processes used in the metal finishing and allied industries which give rise to toxic effluents, and indicates the nature of those effluents. Many of the processes are used in the preparation of, and for the protection and/or decoration of, a variety of metal and non-metallic surfaces. These processes include degreasing, pickling, dipping, stripping, etching, brightening, and polishing, and the production of corrosion-resistant, wear resistant or decorative films and deposits by chemical or electrochemical means. The paper indicates the general nature and ranges of composition of mixed effluent flows from differing plating and anodizing sequences, including the usual pre-cleaning processes but excluding any effects from the disposal of strong waste processing solutions. Typical effluents from an automatic plant for copper, nickel and chromium plating of zinc-base diecastings; from nickel, copper, nickel and chromium plating of ABS type plastics; from a hard chromium plating plant; from an automatic barrel zinc and cadmium plating and passivating plant; from a mixed manually-operated barrel and rack plating plant; and from a sulfuric acid anodizing plant, including chemical bright dipping, are presented. (Aguirre-Texas)
W70-09340

EFFECT OF TOXIC WASTES ON TREATMENT PROCESSES AND WATERCOURSES,
Water Pollution Research Lab., Stevenage (England).
S. Jackson, and V. M. Brown.
Water Pollution Control, Vol 69, No 3, p 292-313, 1970.

Descriptors: *Biological treatment, *Water pollution, Effects, Toxicity, Wastes, Anaerobic digestion, Watercourses, *Waste water treatment.
Identifiers: *Toxic wastes.

Anaerobic digestion of sewage sludge is more sensitive than aerobic sewage treatment to inhibition by toxic substances, notably chlorinated organic compounds and heavy metals. Nitrification is the most sensitive aspect of the aerobic processes, although considerable acclimatization to inhibitors is possible. In general, biological treatment processes are able to protect watercourses from a variety of toxic organic compounds, after acclimatization at least, by degrading them; others are removed, to different extents, by volatization, adsorption or precipitation. Quite large proportions of some organic substances, and of some heavy metals, are not removed, and pass on to the receiving watercourse. The impact of toxic substances on watercourses is usually assessed in terms of their toxicity to fish. Although this is a very important criterion, it must be borne in mind that the presence of a population of fish does not guarantee the wholesomeness of a watercourse in all respects. Data are available on the toxicity of many substances to fish but they are usually limited to determinations of the LC50 in 48 to 96 hours at high concentrations of poison. There is still great uncertainty about the long-term toxic effects of much lower concentrations under natural conditions. Further investigations are in progress to provide a really satisfactory basis for defining toxic limits under natural conditions. (Aguirre-Texas)
W70-09341

WATER TECHNOLOGY,
Rice (Cyrus Wm.) and Co., Pittsburgh, Pa.
For primary bibliographic entry see Field 03A.
W70-09361

FORAGE CROP IRRIGATION WITH OXIDATION POND EFFLUENT,
Mississippi State Univ., State College. Water Resources Research Inst.
James B. Allen, and John C. McWhorter.
Available from NTIS as PB-193 705, $3.00 in paper copy, $0.65 in microfiche. Water Resources Research Institute, Completion Report, July, 1970. 31 p, 9 tab, 6 fig, 12 ref, append. OWRR Project A-040-MISS (2).

Descriptors: *Irrigation, *Oxidation lagoons, Effluents, Mississippi, *Sundangrass, Crops, *Forage grasses, Biochemical oxygen demand, Coliform, Nutrients, *Water reuse, *Crop production, Waste water treatment, Forages, Nitrogen, Phosphates, Waste water disposal.
Identifiers: Sudax forage.

It is a matter of public concern that effluents from oxidation lagoons have caused high BOD, coliform, and nutrient levels in the receiving streams. The purpose of this study was to investigate irrigation as a means of disposing of oxidation pond effluent before it reaches streams. Test plots of Sudax forage were furrow irrigated using three irrigation treatments (oxidation pond effluent, conventional irrigation and no irrigation) and two nitrogen fertilizer levels (0 and 240 lbs/acre). A total of 13.4 inches of water was applied during the June-September growing season, and rainfall was 15.9 inches. The yield response to irrigation was small because of a high ground water level in the test plot area. Yield response to nutrients contained in the oxidation pond effluent were also small. These nutrients were not sufficient to maintain a high level of crop production. No problems were encountered with odor, waterlogging of the soil, or reduction of the infiltration capacity of the soil. However, high ground water levels prevented the use of the plot area for the disposal of oxidation pond effluent during the late winter of 1969-70.
W70-09423

SEWAGE PLANT GRINDER PUMP,
Coast Guard, Baltimore, Md. Field Testing and Development Center.
O. M. Halstad.
Available from NTIS as AD-706 709, $3.00 in paper copy, $0.65 in microfiche. Phase 1, Rept no USCG-506, 12 Mar 70. 13 p, 6 fig.

Descriptors: *Sewage, Ships, Pumps, Sewage disposal, Wastes, Waste disposal.
Identifiers: Macerator, Comminutor, Grinder.

Evaluation of a grinder pump as an improved means of waste solids comminution. Performance

of the grinder pump compared to expanded metal screen hydraulic comminutor in its ability to break up waste solids. Efficiency of the grinder pump shown to be superior to expanded metal screen hydraulic comminutor.
W70-09446

PRELIMINARY WATER AND WASTE MANAGEMENT PLAN.
Sacramento Regional Area Planning Commission, Calif.

Available from NTIS as PB-191 351, $3.00 in paper copy, $0.65 in microfiche. Report to the Sacramento Regional Area Planning Commission, November, 1969. 126 p.

Descriptors: *Waste water treatment, *Sewage systems, *Water supply, Water demand, Waste treatment.
Identifiers: Sacramento County, Yolo County, Placer County, El Dorado County, Folsom, Galt, Isleton.

A considerable amount of water and waste management planning has been done by individual entities within the Sacramento regional area during the past several years. As a result, a good base has been established for solving problems and planning for future development. The predicted future growth, a 40 percent increase in population by 1980 and 73 percent by 1990, indicates further demands will be made upon the land, water and air. At the present time there are 50 waste treatment facilities located in Sacramento County. With the increasing demands on the water resources of the region for water supply, recreation and aesthetic enjoyment, additional constraints will be placed upon waste disposal in the future. The long range waste management plan envisions maximizing waste water reclamation particularly in areas such as Woodland, Davis, Roseville and Placerville which are adjacent to agricultural areas. In northeast Sacramento County groundwater recharge with reclaimed waste water also appears possible. Consolidation of facilities in Sacramento County appears feasible and desirable to eliminate a number of the small waste treatment plants. The construction of a joint outfall for conveying treated waste water from West Sacramento to Hood appears less costly than advanced waste treatment. In areas outside of Metropolitan Sacramento, future waste treatment and disposal needs can be met for the most part by expanding existing facilities, possibly adding advanced waste treatment.
W70-09453

AUTOMATED ACTIVATED SLUDGE PLANTS WITH RESPIRATORY METABOLISM CONTROL,
Omnium d'Assainissement, Paris (France).
P. Brouzes.
In: Advances in Water Pollution Research, Proceedings Fourth International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, Sec II, Paper 5, September 1968. 12 p, 9 fig, 6 ref.

Descriptors: *Activated sludge, *Automation, *Control, *Metabolism, *Respiration, Automatic control, Control systems, Growth rates, Oxygen demand, Oxygen requirements.
Identifiers: Auto-oxidation.

Sewage treatment plants have profited little from the numerous studies and the basic theories relating to the growth of cultures of micro-organisms. The main reason is probably the difficulty in controlling instantaneously the pollution load received at these plants. As a result, the energy consumption for oxygenation is excessive and the growth rate of the culture varies uncontrolled. The pollution load and its variations can be determined with very good approximation, by treating the characteristic parameters by means of an analog computer. The energy consumption for oxygenation is reduced, since it corresponds at each moment to the actual pollution load. Control equipment varying in type from the simpler regulator to the analog computer, have been adopted for adjusting the two basic factors of air input and excess sludge removal. Excess sludge removal is achieved automatically in accordance with the desired operating conditions and the instantaneous pollution load, which the air input is adjusted so as to maintain a constant concentration of dissolved oxygen. Applying this control over the growth rate has enabled the power used to be reduced by 25% with a slight increase in the amount of BOD removal by the aeration plant. (See also W70-08627) (Aguirre-Texas)
W70-09502

ENERGY AND HYDRAULIC TESTS ON MECHANICAL AERATION SYSTEMS,
Emschergenossenschaft, Essen (West Germany).
E. Knop, and K. H. Kalbskopf.
In: Advances in Water Pollution Research, Proceedings Fourth International Conference on Water Pollution Research, held in Prague, Czechoslavakia, April 21-25, 1969: Pergamon Press, Ltd, Sec II, Paper 11, September 1968. 14 p, 15 fig, 2 ref.

Descriptors: *Activated sludge, *Energy, *Hydraulics, *Testing, Aerating, Energy transfer, Equipment, Hydraulic properties, Hydraulic radius, Mechanical equipment, Mixing.
Identifiers: *Mechanical surface aerators.

The design and operation of mechanical surface aerators may be subdivided into three groups which may be termed cone aerators, jet aerators, and bruch aerators. The results achieved so far and the general observations made on a BSK turbine, various types of simplex cones, and a mammoth rotor by the Emscher Association are presented. In the activated sludge process, mechanical surface aerators must not only furnish the oxygen requirements for biological treatment, but they must also ensure turbulent mixing of waste water and activated sludge, preventing sludge deposits within the aeration tank by creating sufficiently high velocities. When a propeller was used in a square tank of 1200 m cubed, the power required to obtain a velocity of some 30 m/sec was 2 W/m cubed of tank contents. In treating waste water by the activated sludge process, the power required for the aeration tank is generally higher: depending on the shape and size of the tank and the applied loading, it is 5W/m cubed to 20 W/m cubed. Thus, most of the power is required for the aeration process. The required power expenditure, at the Emscher Mouth pilot plant, ranged from about 0.1 kWh/kg BOD5-removed at an influent BOD5 of 200 mg/l to 0.4 kWh/kg BOD5-removed at an influent BOD5 of 60 mg/l. The corresponding oxygen requirements ranged from 0.25 to 0.75 kg O2/kg BOD5 in influent. (See also W70-08627) (Aguirre-Texas)
W70-09503

FLUCTUATION OF EFFLUENT QUALITY IN ACTIVATED SLUDGE PLANTS,
Bureau of Sewage Treatment Operation Pribram (Czechoslovakia).
Ivan Spicka.
In: Advances in Water Pollution Research, Proceedings Fourth International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, Sec II, Paper 2, September 1968. 8 p, 3 fig, 22 ref.

Descriptors: *Activated sludge, *Effluents, *Fluctuations, *Kinetics, Biochemical oxygen demand, Chemical oxygen demand, Mathematical models.
Identifiers: Extended aeration, High-rate activated sludge, Resistance index, Sludge activity index, Volatile suspended solids.

The fluctuations of effluent quality from various modifications of activated sludge systems are described in terms of the theory of kinetics of activated sludge processes. Because metabolism of complex substances brings about a significant change in structure and composition, it is suggested that the filtrate BOD removal rate (sludge activity index) per unit weight of organisms is a function of the availability index rather than a function of substrate concentration. The suspended solids removal rate is primarily a function of sludge settling characteristics. At the present time there is no way to control the sludge settling conditions. It is predicted that the resistance index increases with decreasing sludge activity index and vice versa. The reliability of the proposed model has been borne out by large-scale experimental data. As far as effluent BOD is concerned, the unremoved hourly BOD in a 24-hour period varied for small extended aeration plants, conventional activated sludge plants and high-rate activated sludge plants within the limits of 60 to 160%, 60 to 170% and 35 to 185% of the average hourly unremoved BOD, respectively. (See also W70-08627) (Aguirre-Texas)
W70-09504

THICKENING CHARACTERISTICS OF ACTIVATED SLUDGE,
Illinois Univ., Urbana.
Richard I. Dick.
In: Advances in Water Pollution Research, Proceedings Fourth International Conference on Water Pollution Research, held in Prague, Czechoslovakia April 21-25, 1969: London, Pergamon Press, Ltd, Sec II, Paper 18, September 1968. 15 p, 9 fig, 1 tab, 11 ref.

Descriptors: *Activated sludge, *Consolidation, Areal, Mathematical models, Rheology, Sedimentation, Settling velocity, Sludge, Yield strength.
Identifiers: *Characteristics, *Thickening.

The settling characteristics of activated sludge differ from those of the ideal suspension on which gravity thickening theories are based. The 'non-ideal' behavior of activated sludge was interpreted in terms of the rheological properties of the suspension. A conceptual model of the hypothesized mechanism of subsidence of activated sludge was developed based on an analysis of forces acting on a mass of sludge. The resulting mathematical expression was inconsistent with prevailing theories of thickening, but was in close agreement with the observed settling behavior of activated sludge. The relative magnitude of the interparticle force was shown to be related to the yield strength of the sludge. It was concluded that the reason activated sludge failed to conform to prevailing theories of thickening was that it had a yield strength at ordinary mixed liquor suspended solids concentrations. The interparticle forces cause a reduction in settling velocity which is not considered in present theories relating to the area requirement for thickeners. The area of the thickening portion of a settling basin need not be considered to be inalterably established by the settling velocity of the rate-limiting concentration of activated sludge. The area can be reduced, or the capacity of an existing basin can be increased, by minimizing the reduction in settling velocity due to interparticle forces with the sludge, by controlling the depth and mixing conditions in the settling basin. (See also W70-08627) (Aguirre-Texas)
W70-09505

KINETIC ASPECTS OF THE TREATMENT OF PHENOLIC WASTES,
P. W. Graham.
In: Advances in Water Pollution Research, Proceedings Fourth International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, Sec II, Paper 8, September 1968. 15 p, 5 fig, 3 tab.

Descriptors: *Activated sludge, *Kinetics, *Phenols, *Treatment, *Wastes, Biological treatment, Efficiencies, Industrial wastes, Mathematical models, Oil industry.
Identifiers: Mass loading.

is now well known that strong phenolic wastes e amenable to biological oxidation, but the ef-tts of the concentration of the waste on the namics of the process have not received a great al of attention. Work on the kinetics of the treat-nt of such effluents derived from gas manufac-e is described. Chromatographic and other alytical procedures have been used to follow the e of oxidation of the phenolic material contained erein, and the information has been supple-nted by bacterial counts. Gas liquors were logically treated over a wide range of dilutions d retention times. The maximum flow rate that uld be applied successfully was dependent on the ution: as the dilution was increased, so the max-um flow rate could be increased. The kinetics of mple continuous culture were used to demon-ate that the concentration of ammonium loride in the liquor was responsible, in part at st, for the observed dilution effects. It was con-ded that design criteria based solely on the con-ntration or mass loading of oxidizable substrate y be inadquate, and should not be applied over a de range of concentrations, unless the inhibitory ects of other constituents are known. (See also 70-08627) (Aguirre-Texas)
70-09506

IOSPHORUS REMOVAL WITH FERRIC ON AND ALUMINUM,
rlsruhe Univ. (West Germany).
hannes Popel.
urth International Conference on Water Pollu-n Research, Sec III, Paper 1, September 1968. p, 4 fig, 6 tab, 10 ref.

escriptors: *Aluminum, *Iron, *Phosphorus, agulation, Costs, Efficiencies, Mathematical dels, Nutrients, Sewage treatment.
entifiers: *Phosphorus removal.

ethods for removing the nutrients in treated wage prior to discharge have been worked out d in the case of phosphorus, coagulation with fer- or aluminum salts has been proved to be a relia- process. A combination of two theories scribes the removal mechanism: (a) adsorption the phosphates on hydroxide flocs and (b) the rmation of FePO4 or AlPO4 by precipitation. ie proposed model, derived on the basis of the echanism of phosphate binding with the respec-e coagulant metal ions, is applicable to generaliz-g and forecasting removal efficiencies in the nge of 45 to 95%. The model is also applicable to wage containing polyphosphates when relating e relative amount of coagulant to moles to total osphorus P. Compared to the relative amount of agulant, the influence of the initial phosphorus ncentration on the removal efficiency will be sig-ficant only when the initial P varies over a wide nge. Subsequent coagulation produces a better fluent quality and more consistant removal sults than simultaneous coagulation. Ferric loride is slightly less efficient than aluminum lfate on the basis of moles of coagulant ion ap-ied per mole of phosphorus, while the coagula-on product of ferric chloride is generally better ttleable than that of aluminum sulfate. A relative osphorus removal exceeding 90 to 95% is onomically not justified. For removal efficiencies the above magnitude the costs for coagulants ill vary depending upon the coagulant and the sponse of the sewage towards the coagulation ocess from approximately 3-10 DM/cap. year nder German conditions. (See also W70-08627) Aguirre-Texas)
70-09507

ICROBIOLOGY OF A WASTE STABILIZA-ION POND,
entral Public Health Engineering Research Inst., agpur (India).
. V. Bopandikar.
: Advances in Water Pollution Research, roceedings Fourth International Conference on Vater Pollution Research, held in Czechoslovakia, pril 21-25, 1969: London, Pergamon Press, Ltd, ec II, Paper 16, September 1968. 7 p, 32 ref.

Descriptors: *Biological treatment, *Microbiology, *Oxidation lagoons, Bacteria, Efficiencies, Lagoons, Microorganisms, Organic Loading, Pathogenic bacteria, Ponds, Viruses.
Identifiers: *Bacterial removal, Viral removal.

Stabilization ponds developed by the author in India successfully treat sewage with an average BOD of 300 mg/l to 10 mg/l at a cost of only Rs. 40,000/MGD as against Rs. 1,000,000/MGD with conventional treatment. No work, however, has been done in India on the reduction of pathogens by pond stabilization treatment. Many variables affect the types and quantities of enteric viruses that occur in sewage and the limitations of available techniques for their detection further complicate attempts to judge their significance. A review of the techniques developed for sampling and concentration of viruses from large volumes of water is presented. Methods employed for collecting sewage samples for quantitative determination of viruses include: (1) the gauge pad or swab method, (2) resin adsorption method, and (3) ultra-centrifugation. It is shown that conventional secondary treatment (including chlorination) is not effective in removing virus contamination. However, marked reduction in the yield of viruses occurred during passages through oxidation ponds. Reduction in coliforms of fecal E. coli and fecal streptococci during 30 days passage through oxidation ponds ranged between 96.0 and 99.9%. (See also W70-08627) (Aguirre-Texas)
W70-09508

INVESTIGATION ON THE CONTROL OF FILAMENTOUS BULKING,
Instituut voor Gezondheidstechniek TNO, Delft (Netherlands).
A. Pasveer.
In: Advances in Water Pollution Research, Proceedings Fourth International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, Sec II, Paper 14, September 1968. 7 p, 4 tab, 15 ref.

Descriptors: *Activated sludge, *Control, Bacteria, Biological treatment, Waste water treatment.
Identifiers: *Bulking, *Filamentous, *Escherichia coli.

An effort was made to gain further understanding of the phenomenon of bulking by isolating the causative organism and studying its properties. These properties will undoubtedly be influenced by the conditions in the activated sludge floc. Therefore, the conditions in the floc and at the floc boundary were also studied. Two years of investigation of an oxidation ditch with bulking sludge resulted in the conclusion that oxygen supply, growth of filamentous organisms, nitrification and denitrification were in some way connected. The causitive organism was found to be Escherichia coli, which shows filamentous growth at pH 5 to 6. Microscopically, the filamentous growth of E. coli is singularly like that of Sphaerotilus. High loads (of carbohydrates) together with a nitrifying flora prevailing in the activated sludge may lead to conditions in which E. coli can thrive in the floc in filamentous form. It is not claimed that every case of filamentous sludge must necessarily be a coli infected sludge. It is believed nevertheless that this type may be rather common, in light of the explanation given and the results of other investigators. (See also W70-08627) (Aguirre-Texas)
W70-09509

COMPARISON OF AERATION EFFICIENCY UNDER PROCESS CONDITIONS,
Rolf Kayser.
In: Advances in Water Pollution Research, Proceedings Fourth International Conference on Water Pollution Research, held in Prague, Czechoslovakia, April 21-25, 1969: London, Pergamon Press, Ltd, Sec II, Paper 10, September 1968. 10 p, 5 fig, 1 tab, 6 ref.

Descriptors: *Activated sludge, *Aeration, *Efficiencies, Biological treatment, Oxygenation, Oxygen requirements.
Identifiers: *Process conditions.

Oxygenation capacity is generally determined in tap water and also, in order to approach process conditions more closely, in biologically purified sewage and tap water with detergents. To do these tests it is either necessary to take the aeration tank out of operation or to construct special test plants. The aim of this work was to work out methods and techniques for determining oxygenation capacity and aeration efficiency under process conditions. Under process conditions the oxygenation capacity and thus also the aeration efficiency can be measured in non-steady state or in steady state experiments. Both methods give the same results. Errors occur less easily if measurements are made in non-steady state experiments, when the overall transfer coefficient can be determined independently of calibration errors of the oxygen electrode. The only measurements necessary for the determination of the oxygenation capacity are: (1) oxygen content in the aeration tank, and (2) respiration rate of the activated sludge. Both values can be measured easily using a membrane covered oxygen electrode. An experimental evaluation with activated sludge revealed a constant oxygen content of 8.1 mg/l and a respiration rate of 11.7 mg/l-hr in a non-steady state experiment. (See also W70-08627) (Aguirre-Texas)
W70-09510

5E. Ultimate Disposal of Wastes

DISPOSAL OF BRINE BY SOLAR EVAPORATION: FIELD EXPERIMENTS,
New Mexico State Univ., University Park.
For primary bibliographic entry see Field 02D.
W70-09150

DEGRADATION OF WASTE WATER ORGANICS IN SOIL,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.
Richard E. Thomas, and Thomas W. Bendixen.
Journal of the Water Pollution Control Federation, Vol 41, No 5, p 808-813, May 1969. 3 tab, 17 ref.

Descriptors: *Soils, *Sludge disposal, *Digestion, *Soil disposal, Yields, Sludge treatment, Costs, Soil microorganisms, Fertility, Fertilizers, Organic wastes, Waste water.
Identifiers: *Loadings.

Land disposal of liquid sludge is economically competitive with other disposal and can have the added attractiveness of being beneficial to the land. The use of land disposal for liquid sludge reduce sludge disposal costs to about $10/ton of dry solids. The results of a series of lysimeter studies show that microorganisms can digest much of the organic carbon contained in primary and secondary waste water effluent. About 80% of organic carbon from septic tank effluent was digested under a wide variety of conditions. Large variations in temperature, loading rate and duration of dosing had no effect on the percentage of organic carbon which was degraded. Organic carbon application rates up to 31 tons/year/acre resulted in soil residues of less than 3 tons/year/acre. Based on typical values for the composition of sludge this would be equal to 100 tons/year/acre of dried digested sludge solids. (Hancuff-Texas)
W70-09329

5F. Water Treatment and Quality Alteration

CONTINUOUS COUNTERCURRENT ION EXCHANGE.

Ind Water Eng, Vol 7, No 2, p 18-38, Feb 1970. 21 p, 12 fig, 8 ref.

Descriptors: *Ion exchange, Chemistry, Chemical engineering, *Capital costs, Distillation, *Demineralization, Chromatography, Water softening, Absorption, Economics Brines, Industrial plants, Fluids, *Resins, Flow rates, Technology, *Water treatment, Apparatus, Waste water treatment, Boiler feed water.
Identifiers: Demineralizers, Exchange capacity.

Unitl the present decade, the development of ion-exchange technology has been based on improvements in the chemistry of the process, with new resins creating new possibilities. A change has taken place, however, with new engineering techniques the dominating factor in development. The Asahi process is very successful, as attested by the many plants built to this design and operating, not only in Japan where the process was developed originally, but also in the U S, Britain, and France. Success of the Asahi process is the result of the essential simplicity. Over 70 continuous countercurrent ion-exchange plants have been designed by Chem-Seps and installed for demineralizing, dealkalizing, and softening water. This process is not dissimilar in principle from the Asahi process, the plant consisting of a closed cycle of adsorption and regeneration vessels in which the resin remains static for a service cycle, interrupted by short periods for resin movement. The difference in technique is essentially one of hydraulics. The continuous system of Paterson Candy is based on a fluidized bed contractor, differing in several respects from an intermittently moved packed bed. (USBR)
W70-09037

RADIOTRACER STUDIES ON RAPID SAND FILTRATION,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
T. F. Craft, and Geoffrey G. Eichholz.
Available from NTIS as PB-193 681, $3.00 in paper copy, $0.65 in microfiche. Engineering Experiment Station, Georgia Institute of Technology, EES Project E-600-705, June 1970. 59 p. OWRR Project B-020-GA (2).

Descriptors: *Rapid sand filters, *Porous media filter, *Radioactive tracers, *Water treatment, *Filtering system, Cesium-137, Filter sands, Radioisotopes, Adsorption, Particle shape, Particle size, Pores, Porosity, Colloids, Flocculation.

The research was designed to provide information on the basic mechanism involved in the action of porous media filters and provide information for improvement of water filter design. Both the theoretical and practical aspects of rapid sand filtration were investigated. Radiotracer techniques were used to measure accumulations of suspended matter in porous filter beds. Filter coefficients were calculated and were used in determining the mechanisms involved when suspended particles are trapped by a porous medium, such as sand or anthracite. Experimental evidence shows that three major actions occur--physical hindrance, interstitial sieving, and the physico-chemical van der Waals and double layer forces. The particular mechanism by which a given particle is trapped in a porous medium is determined primarily by the size of the particle. There is a gradual transition between applicable mechanisms, but the relative effectiveness depends on the particle size. The effectiveness of anthracite and normally graded, reverse graded and uniform sand was evaluated in a series of long filter runs. From the standpoint of head loss, anthracite plus sand or anthracite alone is superior. Other media in order of decreasing effectiveness are reverse graded sand, uniform sand, and normally graded sand. When all factors are considered, anthracite plus sand was found to be the best choice for filter media. The report contains 22 illustrations and 9 references. (Conway-Georgia Tech)
W70-09091

A MODEL OF WATER QUALITY MANAGEMENT UNDER UNCERTAINTY,
Chicago Univ., Ill.
For primary bibliographic entry see Field 06A.
W70-09109

5G. Water Quality Control

WATER QUALITY PLANNING AND MANAGEMENT (PLANNING ESSENTIAL TO INSURE WATER QUALITY),
California State Water Resources Control Board, Sacramento.
Philip N. Storrs, and Jerome B. Gilbert.
American Water Works Assn. Journal, Vol 62, No 3, Mar 1970, p 141-144.

Descriptors: *Water resources development, *Water quality, *Management, *Planning, Water users, Damages, Maintenance, Water quality control, Water requirements, Water demand, Water management (Applied), Water policy, Water shortage, Water supply, Water utilization, Public health, Standards, Administration, Social aspects, Long-term planning, Future planning (Projected), Coordination, Governments, Programs.

In the past, water resources development has been based on expediency, as water quantity was the primary concern of water users. However, the importance of water quality in water resources development is now being recognized. Moreover, in order to avoid irreparable damage to our water resources, rational and comprehensive water resources planning and management must be utilized. In planning for the maximum use of water resources which are consistent with their maintenance and protection, consideration should be given to the interrelationship between water development and usage and water quality because changes in one aspect of a water resources system may have far-reaching consequences in other areas of water use. Therefore, there is a need for a comprehensive water planning program which would be based on a defined water system and which would consider the relationships of all water uses in such system. Furthermore, it is imperative that the planning agency develop broadly based programs in such a manner as to coordinate planning at all levels of government. This overall planning is essential in order to insure an adequate supply of quality water for the future. (Finman-Florida)
W70-09056

APPLICATION OF SPECIALIZED OPTIMIZATION TECHNIQUES FOR WATER QUALITY AND QUANTITY MANAGEMENT WITH RESPECT TO PLANNING FOR THE TRINITY RIVER BASIN,
Texas A and M Univ., College Station. Water Resources Inst.
W. L. Meier, Jr., and C. S. Shih.
Available from NTIS as PB-193 684, $3.00 in paper copy, $0.65 in microfiche. Water Resources Institute, Technical Report 30, July 1970. 115 p, 11 tab, 20 fig, 40 ref. OWRR Project B-024-TEX (1).

Descriptors: *Optimization, Water resources planning, Water quality, Management, Dynamic programming, Operations research, *Systems analysis, *Waste water treatment, *Water treatment, *Low flow augmentation, Texas.
Identifiers: Planning, Optimization, Management, Water quality, Systems analysis, Trinity River (Texas).

Techniques are developed and presented forming the basis for the development of water management plans which include consideration of water quality and quantity in the same model. The methodology described in this report utilizes a dynamic programming approach in devising the mix of waste treatment, water treatment, and low flow augmentation to minimize the total cost of developing and operating the system while being regulatory in aesthetic restrictions. Use of these procedures permits the evaluating of the trade-off between costs for water and waste treatment and reservoir releases for quality control plus a consideration of the economic returns afforded b recreational use of the water. This investigatio represents more of a systems approach to wat quality management than the studies heretofo completed. Advances in the optimization of no serial multistage systems are presented in the r port along with a discussion of the computation solution of such systems. Example problems are i cluded illustrating the use of the techniques. (Me er-Texas A and M)
W70-09094

HEAT WASTE,
Rosenstiel School of Marine and Atmospher Sciences, Miami, Fla.
For primary bibliographic entry see Field 05B.
W70-09162

A CONTRIBUTION TOWARDS THE REDUC TION OF ICE FOG CAUSED BY HUMI STACK GASES AT ALASKAN POWER STA TIONS,
Glasgow Univ. (Scotland); and Dartmouth Coll Hanover, N.H.
Andrew Porteous, and Graham B. Wallis.
Atmospheric Environment, Vol. 4, p 21-33, 197 10 fig, 10 ref.

Descriptors: *Fog, *Ice, *Humidity, Gases, The mal powerplants, Drying, Moisture uptake, Alask Design data, Ducts, Velocity, Drops (Fluids).
Identifiers: *Ice fog, *Visibility problem.

The humid power station gases at U. S. Army an Air Force Bases in Alaska can cause considerabl ice fog visibility problems. The evaluation of var ous alternatives for drying the humid stack gase shows counter-current scrubbing to be a viabl solution where plentiful water supplies exist. Hig moisture removal rates can be easily accomplishe as shown by the experimental results. The goo agreement between theory and experiment enable spray towers to be designed to cope with the dehu midification of stack gases. The complete scrubber for the conditions at a typical air base then designed for a gas velocity of 2.1/m.sec, wit an active contact height of 10 m, to handle a we total of 246,000/kghr of flue gases. Consideratio is given for optimum droplet size to accomplis both grit and moisture removal from the gases. (H sieh-Vanderbilt)
W70-09172

THE OPTIMIZATION OF STORM-HOLDIN TANKS: A PROBLEM OF WATER POLLUTIO CONTROL,
Stanford Univ., Calif.
Charles Albert Kohlhaas.
Available from University Microfilms, Ann Arbo Michigan, $15.30 per copy or $4.35 on microfilm Ph.D. Dissertation, February, 1970. 321 p.

Descriptors: *Optimization, *Storm drain *Economics, Soical aspects, Recreation, Mathe matical models, Chlorination, Settling tanks, Infi tration, Computer programs.
Identifiers: *Storm sewage, *Combined sewer *Storage tanks, Non-linear programming, Effluen tax, San Francisco Bay.

A literature review of the hydrology, quality, effec on the environment, and control technology o combined sewer overflows and overflows fro sewers subject to heavy infiltration is made. A analysis of water pollution externalities an remedies for dealing with them, including the us of the effluent tax in particular, is given. The rela tionship between the pollution caused by storm sewage overflow and competing urban needs is in vestigated. Two mathematical programs for op timizing control facilities form storm-sewage over flows are defined - one achieves economic efficien cy by means of the effluent tax, the other incor porates water quality goals by means of strean standards. The stream standards program is applie to a practical problem of storm-sewage overflow i

East San Francisco Bay, California. Water quality regulations for controlling overflows are formulated and treatment processes based on the use of holding tanks are defined. The effect of a holding tank on input discharge, BOD, and coliform concentrations is described. Graphs relating BOD load and average coliform concentration of holding tank effluent to tank capacity are employed to size holding tanks capable of meeting effluent standards. The mathematical program is solved as a separable non-linear program. Detention times needed to satisfy BOD limitations were more than adequate to meet limitations on coliform concentrations. For most cities the high cost of solutions to storm-sewage overflow problems will prevent the implementation of control measures in the near future. An effluent tax may be used as a means of financing alternative recreation and as an incentive for implementation of control measures. Requirements concerning maximum coliform concentrations are best met by limitations on the minimum size of holding tanks. Optimization models capable of incorporating an almost infinite number of holding tanks and over 2,000 water quality requirements may be constructed. (Kohlhaas-Stanford)
W70-09181

OPTIMAL RESOURCE ALLOCATION AND SOME TECHNIQUES OF OPTIMIZATION,
Purdue Univ., Lafayette, Ind.
Edna T. Loehman.
Purdue University Doctor of Philosophy Thesis, Purdue Library, August, 1970. 186 pages, 18 fig, 2 tab, 4 ref. OWRR Project B-020-IND (2).

Descriptors: Mathematical models, *Resource allocation, Resource Development, *Optimization, *Water pollution, Treatment facilities, Waste disposal.
Identifiers: Second best behavioral model, Algorithms, Zero-one programming.

This thesis is a collection of papers dealing with optimal allocation of water resources. The first paper discusses the problem of the Second Best. What is meant by 'second best' is made clear by using as examples two cases of market imperfection: monopoly and an externality due to water pollution. The second paper extends the modeling of a water pollution externality to a time-varying case. It is shown that restrictions on the polluter for optimal resource allocation should vary with streamflow. The third paper presents algorithms and a computer program for zero-one integer programming. The algorithms are tree search methods where the search is guided by an associated linear programming problem. The last section of the thesis is a proposal for further work in the area of treatment plant financing and design. A bargaining model is proposed to determine location and capacity of a treatment facility given that bargaining participants have rights to use a certain proportion of the facility and must pay a certain proportion of fixed costs as well as price per unit of treatment.
W70-09182

SPACE HEATING IN URBAN ENVIRONMENTS,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 08C.
W70-09192

USE OF TOPOLOGIC INFORMATION IN PROCESSING DATA FOR CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N.Y.
For primary bibliographic entry see Field 07C.
W70-09204

SOME EFFECTS OF FRESH-WATER INFLOW ON THE FLUSHING OF SOUTH SAN FRANCISCO BAY: A PRELIMINARY REPORT,
Geological Survey, Washington, D.C.
D. S. McCulloch, D. H. Peterson, P. R. Carlson, and T. J. Conomos.
Available free on application to the U S Geological Survey, Washington, DC 20242. In: A Preliminary Study of the Effects of Water Circulation in the San Francisco Bay Estuary, U S Geological Survey Circular 637-A, p A1-A27, 1970. 27 p, 15 fig, append.

Descriptors: *Estuaries, *Water circulation, *Bays, *California, *Water quality, Nutrients, Sewage disposal, Water pollution sources, Path of pollutants, Water pollution control, Tides, Currents (Water), Discharge (Water).
Identifiers: *San Francisco Bay.

Data are provided for those interested in optimum development of the San Francisco Bay estuary. A clear understanding of this estuary system is necessary for evaluating such things as the ability of the estuary to assimilate agricultural, municipal, and industrial waste products; the relation between the amount of freshwater inflow and the quality of the bay water; and the movement of water masses and entrained material within the estuary. The seasonal salinity variation of the south bay is largely controlled by fresh water from the Sacramento River under present conditions and is nearly unaffected by the comparatively minor discharge of south bay streams and sewage. The change in phosphate concentration corresponds with the seasonal change in the Sacramento River discharge. Apparently changes in net flow of fresh water to the bay from this source is an important controlling factor in flushing of the south bay. Soluble waste materials are removed from south bay largely during periods of high river discharge. (Knapp-USGS)
W70-09215

DRAIN INSTALLATION FOR NITRATE REDUCTION,
Agricultural Research Service, Brawley, Calif. Southwestern Irrigation Field Station; Soil Conservation Service, Fresno, Calif.; and Bureau of Reclamation, Sacramento, Calif. Land Resources Branch.
L. S. Willardson, B. D. Meek, L. B. Grass, G. L. Dickey, and J. W. Bailey.
Groundwater, Vol 8, No 4, p 11-13, July-August 1970. 3 p, 2 fig, 2 tab, 2 ref.

Descriptors: *Denitrification, *Biodegradation, *Nitrates, *Groundwater, *Drainage systems, Subsurface drainage, Drawdown, Water level fluctuations, Saturated flow, Unsaturated flow, Aeration.
Identifiers: Groundwater denitrification.

A field experiment was installed near Firebaugh in the San Joaquin Valley of California to test submerged drains as a means of denitrification of groundwater. Laboratory and field experiments show that denitrification occurs in saturated soil where there is ample organic carbon available for bacterial metabolism. Denitrification and dilution of high nitrate groundwater were accomplished in the field study. (Knapp-USGS)
W70-09228

ENVIRONMENTAL QUALITY.
Council on Environmental Quality, Washington, D.C.

Report available for inspection in USGS-WRD Library, Wash, D C. For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C 20402 - Price $1.75 (paper copy). First Annual Report of the Council on Environmental Quality together with President's Message, transmitted to Congress August 1970. 326 p, 10 fig, 10 tab, 12 append.

Descriptors: *Environmental sanitation, *Water policy, *Governments, Waste disposal, Land use, Air pollution, Water pollution, Pesticides, Solid wastes, Population, Political aspects, Water resources development, Ecotypes, Waste treatment, Water quality control, Cost analysis.
Identifiers: *Environmental quality, *Ecological problems.

A comprehensive and useful statement is given of the principal environmental issues that confront the nation - water pollution, air pollution, inadvertent modification of weather and climate, disposal of solid wastes, problems of land use, pesticides, and radiation. Prepared by the Presidents's Council on Environmental Quality and transmitted to the Congress August 10, 1970, the report describes the problems and issues which need to be attacked, but offers no overall solutions. Pressures on the environment are discussed in a chapter on population, economic growth, and resources. An important proposal is made for a national land use policy. In water pollution, the report urges an increase in funds for waste treatment; a program in one river basin to demonstrate concepts of water quality management; effective enforcement of water quality standards; a strong Federal policy to control thermal pollution; development of a policy for ocean disposal of wastes; creation of new methods to prevent, control and clean up oil spills; and intensified attacks on agricultural pollution. Costs to clean up the nation's water over the next 10 years will total $10 billion. (Lang-USGS)
W70-09347

EVALUATION PROCESSES IN WATER RESOURCES PLANNING.
American Water Resources Association, Urbana, Ill.
For primary bibliographic entry see Field 06B.
W70-09369

PROCEEDINGS WORKSHIP ON MOSQUITO CONTROL IN NORTH CAROLINA,.
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 06G.
W70-09421

THOMPSON V CITY OF PHILADELPHIA (DAMAGE CAUSED BY CITY MAINTAINED SEWAGE SYSTEM).

177 So 39-40 (Miss 1937).

Descriptors: *Mississippi, *Drainage systems, *Sewage disposal, *Compensation, *Eminent domain, Damages, Drainage programs, Drainage, Overflow, Judicial decisions, Legal aspects, Sewage, Local governments, Natural streams, Public benefits, Riparian land, Riparian rights, Drainage effects, Drainage water, Water pollution sources, Watercourses (Legal).

Defendant city maintained a sewage system, part of which included a natural watercourse flowing through plaintiff's property. Plaintiff contended that such drainage through his land caused offensive odors, rendered the water unusable and caused the watercourse to overflow from time to time, thereby resulting in a reduction in the value of his property. Defendant contended that absent proof of negligent construction and maintenance of said system, it could not be held liable to plaintiff in damages. The court held that defendant was liable for any special and different damage suffered by plaintiff not common to the general public if caused by the construction and maintenance of the system, whether properly constructed and maintained or not. Such liability was not dependent on negligence, but on the taking or damaging of private property. The judgment for defendant was reversed. (Price-Florida)
W70-09484

WATER QUALITY: A CONCERN FOR AGRICULTURAL ENGINEERS,
Cooperative State Research Service, Washington, D.C.
Paul E. Schleusener.
Agricultural Engineering, Vol 51, No 6, June 1970. 359 p.

Descriptors: *Water management (Applied), Water quality control, Waste water treatment, Sewage effluents.

Identifiers: *New York State Health Department, Long Island.

The challenge facing agricultural engineers in the field of water management is to devise alternative methods of maintaining water quality within the agriculture industry before effluent charges are enacted for different phases of the production and processing operations. The author cites an example of Long Island duck growers who banded together to install waste treatment systems with the cooperation of the New York State Health Department. Although the duck growers financed the waste treatment facilities with their own funds, the government regulatory agency coordinated the operation to insure that they met state and national water quality standards. (Holmes-Rutgers)
W70-09499

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

WATER QUALITY PLANNING AND MANAGEMENT (PLANNING ESSENTIAL TO INSURE WATER QUALITY),
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 05G.
W70-09056

OPTIMIZATION OF WATER RESOURCES SYSTEMS BY THE GRADIENT PROJECTION AND THE CONJUGATE GRADIENT METHODS,
Kansas State Univ., Manhattan. Dept. of Industrial Engineering.
E. S. Lee, and S. Waziruddin.
Available from NTIS as PB-193 682, $3.00 in paper copy, $0.65 in microfiche. Completion Report, (1970). 102 p, 12 tab, 24 fig, 24 ref, 2 append. OWRR Project C-1032 (Number 1962) (1).

Descriptors: *Modeling, *Optimal management, *Water resources, *Gradient projection method, *Conjugate gradient method, Dynamic programming.

The gradient projection and the cojugate gradient methods are applied to the optimization of complex water resources systems. The most important advantages of these approaches are that they can be used to solve nonlinear problems with a large number of inequality constraints. Furthermore, these techniques can handle water resources systems with complex topological structures such as nonserial or branching reservoirs. Four water resources models with different complexity are solved by these methods. The results show that the convergence rate is quite fast and only a small amount of computer time and computer memory are needed to solve a fairly complex problem. These requirements on the computer time and computer memory are almost negligible compared to that required by the dynamic programming approach. (Lee-Kansas State)
W70-09092

APPLICATION OF SPECIALIZED OPTIMIZATION TECHNIQUES FOR WATER QUALITY AND QUANTITY MANAGEMENT WITH RESPECT TO PLANNING FOR THE TRINITY RIVER BASIN,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 05G.
W70-09094

METHODS OF COMPUTING MAXIMUM SOIL FREEZING DEPTH,
For primary bibliographic entry see Field 02C.
W70-09104

INDIRECT METHOD FOR COMPUTING THE DURATION OF PRECIPITATION,
For primary bibliographic entry see Field 02B.
W70-09106

A MODEL OF WATER QUALITY MANAGEMENT UNDER UNCERTAINTY,
Chicago Univ., Ill.
Charles Upton.
Water Resources Research, Vol 6, No 3, p 690-699, June 1970. 10 p, 12 ref.

Descriptors: *Water pollution control, *Water management (Applied), *Streamflow forecasting, *Stochastic processes, Probability, Standards, Water quality, Waste water treatment, Model studies, Statistical models, Mathematical models, Systems analysis.
Identifiers: *Water quality management.

Although the problems of water quality management are usually analyzed in the context of nonstochastic models, such an analysis may be misleading because of the substantial stochastic elements in streamflow. The effects of variance in streamflow are considered in this paper. The analysis shows that the problems of uncertainty may be dealt with by selecting a critical value of streamflow and then by treating pollutants sufficiently so that if streamflow falls above (or below) that critical value the water quality standard will (or will not) be met. The greater the variance in streamflow, the lower the optimal critical value. Further, the level of treatment of pollutants is higher under uncertainty than it would be if there were no variance in streamflow. (Knapp-USGS)
W70-09109

TIME BIAS IN RECREATION BENEFIT ESTIMATES,
Battelle Memorial Inst., Columbus, Ohio, and George Washington Univ., Washington, D.C. Natural Resources Policy Center.
Frank J. Cesario, and Jack L. Knetsch.
Water Resources Research, Vol 6, No 3, p 700-704, June 1970. 5 p, 3 fig, 7 ref.

Descriptors: *Cost-benefit analysis, *Recreation, *Demand, *Water management (Applied), Economics, Economic justification, Decision making, Planning, Costs, Feasibility studies, Resource allocation, Water demand, Estimating.
Identifiers: Recreation demand.

Indirect methods are generally necessary to measure outdoor recreation benefits. A widely proposed technique involves estimating demand schedules using travel cost data as a proxy for prices. A major problem involved with this method as it has been applied is a serious conservative bias in the estimates, owing to the improper accounting of the constraint imposed by time costs on recreational visits. The bias is examined and corrections are suggested that could improve the estimates. The degree of ultimate improvement seems to depend on better data and on an understanding of the trade-off function between time and cost outlays for this form of travel. (Knapp-USGS)
W70-09110

STOCHASTIC MODELS IN HYDROLOGY,
Illinois Univ., Urbana.
Adrian E. Scheidegger.
Water Resources Research, Vol 6, No 3, p 750-755, June 1970. 6 p, 13 ref.

Descriptors: *Stochastic processes, *Statistical models, Probability, Mathematical models, Model studies, Mathematical studies, Statistics, Markov processes, Time series analysis.
Identifiers: Stochastic models.

The stochastic models that can be used to represent growth and steady state phenomena in hydrology are reviewed. There are essentially two types of growth models possible; the cyclic growth model and the random configuration model. For steady state phenomena (time series) we are genera restricted to a Gaussian type of model with without autocorrelation. Self-similarity mod (fractional Brownian motion) lead to physically surd conditions if they are extrapolated to hi frequencies. (Knapp-USGS)
W70-09115

A TWO-STEP PROBABILISTIC MODEL STORAGE RESERVOIR WITH CORRELATI INPUTS,
Toronto Univ. (Ontario).
V. Klemes.
Water Resources Research, Vol 6, No 3, p 75 767, June 1970. 12 p, 8 fig, 10 ref.

Descriptors: *Statistical models, *Reservoir yie Probability, Streamflow forecasting, Reserv storage, Reservoir operation, Safe yield, Stochas processes, Mathematical models.
Identifiers: Reservoir yield forecasting, Reserv management.

Fragmentation of Moran's (Aust J Appl Sci 5:1 1954) model and decomposition of its transiti matrix into a release rule and an input compone are used to simplify the problem formulation reservoirs with complex operating rules. The Llo (J Hydrol 1:99, 1963) model may be deriv directly from that of Moran by introducing two su cessive transitions of one variable instead of a si gle bivariate transition. Combined with Gould's Inst Eng, Aust 33:405, 1961) concept of transiti probabilities, the suggested model is used to ta into account the correlation between month flows simultaneously with that between annu flows. (Knapp-USGS)
W70-09116

OPTIMAL RESOURCE ALLOCATION AN SOME TECHNIQUES OF OPTIMIZATION,
Purdue Univ., Lafayette, Ind.
For primary bibliographic entry see Field 05G.
W70-09182

ECONOMICS OF CANNERY WASTE TREA MENT,
Water Resources Engineers, Inc., Walnut Cree Calif.
For primary bibliographic entry see Field 05D.
W70-09338

BOD MASS BALANCE AND WATER QUALIT STANDARDS,
Rutgers - The State Univ., New Brunswick, N.
Water Resources Research Inst.
For primary bibliographic entry see Field 05A.
W70-09349

ON THE SYSTEMS APPROACH IN HYDROLO GY,
Purdue Univ., Lafayette, Ind. Dept. of Aeronautic Astronautics, and Engineering Sciences.
For primary bibliographic entry see Field 02A.
W70-09385

HYDROLOGICAL SERIES AS A BASIS FO WATER RESOURCES POLICY,
Technische Hochschule, Munich (West Germany)
W. Bechteler.
Bulletin International Association of Scientifi Hydrology, Vol 15, No 2, p 7-10, June 1970. 4 p, fig, 5 ref.

Descriptors: *Statistical methods, *Time serie analysis, Data collections, Hydrologic data Frequency analysis, Streamflow forecasting, Wate policy, Water management (Applied), Wate resources development.
Identifiers: Hydrologic series.

A necessary basis for resolving many problems con cerning water resources policy and hydrology is th

use of long, homogeneous records of stages and discharges. Although in many countries long records of water stages are available, unfortunately many series are of no use, due to mistakes, gaps, or inhomogeneities. Stage series may often show trends caused by changes of the elevation or character of the river-bed. Therefore it is absolutely necessary to test the homogeneity of each series before it is used for any further investigations. A test of homogeneity, in most cases, is only possible with the help of statistical methods. (Knapp-USGS)
W70-09387

A SYSTEM APPROACH FOR THE STUDY AND CONTROL OF FACTORS AFFECTING WATER POLLUTION,
Mississippi State Univ., State College. Water Resources Research Inst.
For primary bibliographic entry see Field 05B.
W70-09422

6B. Evaluation Process

ELECTRIC POWER - IMPACT ON THE ENVIRONMENT,
California Public Utilities Commission.
John J. Doran, Jr.
Amer Power Conf, (Paper) Chicago, Ill, Apr 1970. 15 p, 1 fig, 2 tab.

Descriptors: *Electric power, Electric power production, Electric power demand, Electric power industry, *Aesthetics, Transmission lines, *Environment, Environmental engineering, *Planning, Nuclear powerplants, Thermal powerplants, California, Electric power rates, Land use, Public opinion, Landscaping, Air pollution.
Identifiers: Electric utilities, *Site selection, Electric power surveys, Pollution control, Air pollution control, Underground cables.

The importance of environment in our country has resulted in delaying electric power construction, and some areas face a possible electric energy crisis. The impact of providing the needed electricity without unduly affecting the environment is a challenge. Governmental agencies and the public utilities, privately and publicly owned, must work cooperatively toward the necessary solution. The more important aspects concerning California's need for additional power generation are discussed. Growth rates for the next 20 yr. public concern on siting, environmental and aesthetic considerations, and underground distribution are reviewed. The challenge of the 1970's to the electric utilities and manufacturers and to the regulatory agencies will be their ability to meet the requirements of the public for an improved environment, including abundant, safe, and reliable electric service at reasonable costs. (USBR)
W70-09020

MAJOR ELECTRIC POWER FACILITIES AND THE ENVIRONMENT,
Edison Electric Inst., N.Y.
For primary bibliographic entry see Field 06G.
W70-09048

TIME BIAS IN RECREATION BENEFIT ESTIMATES,
Battelle Memorial Inst., Columbus, Ohio, and George Washington Univ., Washington, D.C. Natural Resources Policy Center.
For primary bibliographic entry see Field 06A.
W70-09110

ON USING A TIME VARIABLE INFILTRATION WITH THE ISRAELSON BORDER IRRIGATION EQUATION,
Saskatchewan Univ., Saskatoon. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
W70-09141

PLANNING OUR FUTURE WATER RESOURCES,
Water Resources Board, Reading (England).
L. E. Taylor.
Chemistry and Industry, No. 21, May 23, 1970, p668-673, 1 tab, 3 ref.

Descriptors: *Water resources development, *Future planning (Projected), *Decision making, *Optimum development plans, Water demand, Feasibility studies, Water costs, Water storage, Reservoir storage, Groundwater, Groundwater recharge, Desalination, Electrodialysis, Environmental effects, Recreation demand.
Identifiers: *England and Wales, Estuarial barrages.

The British national problem in water resources is storage and distribution, as sufficient rain falls on the island to meet all likely needs for many years to come. It was estimated that 3000 MGD of new resources must be made available by 2001. For this purpose, the following proposals were discussed: (1) Major groundwater developments in the south east of the country. An important factor is the extent to which recirculation takes place between the river and the aquifer. (2) Artificial recharge of aquifers. The Water Resources Board is investigating the possibility of augmenting the natural infiltration to the Bunter Sandstone by means of artificial recharge. (3) Estuarial barrages. Experts are now studying the ecological and biological implications of the use of Morecambe Bay to conserve water. (4) Trent research program. This program was to determine the various ways in which the river might be made suitable for supply purposes and to assess their economic viability. (5) Desalination. The cost is about 6 s/1000 gal, which is too expensive compared to about 2 s/1000 gal for freshwater sources. (Hsieh-Vanderbilt)
W70-09153

SOIL, WATER AND SUBURBIA.
Department of Agriculture, Washington, D.C.; and Department of Housing and Urban Development, Washington, D.C.

Report of the proceedings of the National Conference on Soil, Water and Suburbia, Superintendent of Documents, U. S. Government Printing Office, Washington, D.C., March 1968. 160 p, 106 fig, 67 ref.

Descriptors: *Urbanization, *Soil-water-plant relationships, *City planning, *Land development, *Soil engineering, *Multiple purpose projects, *Soil stabilization, *Land use, *Administration, *Watershed management, *Soil conservation, *Soil management, Economics, Land reclamation, Federal project policy.
Identifiers: *Water-soil management, *Land use policies, Suburban land, Multidisciplinary planning.

Papers by 27 authorities in various professions, presented at the National Conference on Soil, Water and Suburbia in Washington, D.C. on June 15-16, 1967, are included in this publication. Comments by prominent discussants are also included. The purpose of the conference was to: (1) examine soil and water problems and opportunities that occur as land shifts from rural to suburban and urban uses; (2) exchange information on sources and types of soil and water management assistance available to public officials, planners, developers and builders; (3) explore the economics of land use changes, devices for reserving land for recreation, methods for maintaining natural beauty and reducing land damage and water pollution in the urban development process, and research needs in these fields; and (4) discuss opportunities for community action in local and regional planning, in improvement of existing public programs, and in establishing guidelines for future federal and state assistance. The broad subject areas covered included: Land in Transition; The Suburban Land Resource and Its Use; Knowledge in Transition; and Community Action. The papers discussed interrelationships between soil, water and people from the standpoints of problem definition and the need and advantages of bringing peiple of various professions and responsibilities together to promote effective problem solving. Multidisciplinary approaches in planning, design, development and construction are emphasized. (Poertner)
W70-09188

A METHOD FOR THE EVALUATION OF THE SYSTEM AND COST EFFECTIVENESS OF LARGE SEA WATER DISTILLATION PLANTS,
Planning Research Corp., McLean, Va.
For primary bibliographic entry see Field 03A.
W70-09247

THE IMPORTANCE OF WATER RELATED ACTIVITIES AT STATE PARKS IN MISSISSIPPI,
Mississippi State Univ., State College. Water Resources Research Inst.
D. C. Williams, Jr., and Donnie L. Daniel.
Available from NTIS as PB-193 686, $3.00 in paper copy, $0.65 in microfiche. Water Resources Research Institute, State College, Mississippi, July, 1970. 70 p. OWRR Project A-033-MISS (1).

Descriptors: *Recreation, *Parks, Recreation facilities, Recreation demand, Mississippi, *Tourism.
Identifiers: State parks, Recreation visitation, *Park management.

The State parks in Mississippi are developed around and oriented to the use of water and related resources. There is a need for information on the number of visitors to the parks and the relative importance of the different water related resources for park management and planning purposes. Total visitation at the parks was obtained by use of mechanical traffic counters. During the course of one year, over 112,000 visitors were interviewed to determine the nature of their activities at the parks. The data were analyzed to determine the relative importance of water related and major non-water related activities for the Park System as a whole and by park. The activeness of visitors in the different parks was also analyzed.
W70-09259

EVALUATION PROCESSES IN WATER RESOURCES PLANNING.
American Water Resources Association, Urbana, Ill.

Publication sponsored by Office of Water Resources Research. Report of a research conference at Milwaukee, Wisconsin, June 16-20, 1970, William Whipple, Jr., Ernest A. Englebert, and Warren L. Trock, Editors, sponsored jointly by AWRA and University of Wisconsin, Milwaukee; 160 p, July 1970.

Descriptors: *Evaluation, *Environment, *Economic efficiency, Benefits, Economics, Ecology, Costs, Economic justification, Urbanization, Decision making, Institutions, Natural resources, Flood plain insurance, Social aspects.
Identifiers: *Effects, *Environmental quality, *Multiple objective planning, Metropolitan area water resources, Urban water problems, Economics of water quality control.

This is the report of an interdisciplinary research conference on evaluation processes in water resource planning. Due to the interests of those participating, the major emphasis was on the subject of multiple objective planning, which is about to be incorporated into Federal approaches by the Water Resources Council. Although the consensus of those present clearly approved of the main thrust of the new proposals, there were many conflicting views expressed both as to the basic significance of the change and as to how it might be implemented. The basic concept of the conference precluded formal papers or attribution of individual views; but the principal viewpoints are summarized in the conference report. Besides multiple objective

planning, other subjects of major interest included the economics of water quality control, flood plain management and flood insurance, special problems of metropolitan water resources analysis, political and economic aspects, and environmental and aesthetic aspects of evaluation processes. (Whipple-Rutgers)
W70-09369

CHAPTER 1: INTRODUCTION.
National Academy of Sciences-National Academy of Engineering, Washington, D.C. Environmental Studies Board.

In: Institutions for Effective Management of the Environment, Washington, D.C. National Academy of Sciences - National Academy of Engineering, January 1970. p 13-16.

Descriptors: *Environment, *Management, Administration, Planning, Monitoring, Education, Communication.
Identifiers: Early warning system, Quick-reaction field function, Quick-reaction analytic function.

A number of functions that must be accommodated if the United States is to have effective environmental management are outlined. They include: (1) Long Range Planning: Development of a long-range strategy for effective management, protection, and use of the environment; (2) Early Warning: It is necessary to develop a system by which possible environmental disasters as well as positive developments for the improvement of environmental quality can be predicted; (3) Monitoring: To understand how man is changing his environment, ways of measuring environmental quality need to be developed; (4) Quick-Reaction Field Function: There is a need to obtain critical data in environmental problem areas on a short-term scale; (5) Quick-Reaction Analytical Function: There is a need to bring together available information in a cogent and timely fashion for decision makers at various levels of government; (6) Education: There is a need for greater numbers of personnel professionally trained in environmental problems and public awareness and concern for the environment; and (7) Communication: Closely coupled to the educational function is the function of making information about the environment available to the public. (See also W70-08929) (Davis-Chicago)
W70-09439

COMPREHENSIVE WATER SUPPLY, SEWERAGE, SOLID WASTE AND AIR POLLUTION CONTROL PLANS,
Palm Beach County Area Planning Board, West Palm Beach, Fla.
David B. Smith, William R. Sabis, and David H. Scott.
Available from NTIS as PB-191 553, $3.00 in paper copy, $0.65 in microfiche. Palm Beach County Area Planning Board, Engineers Project No 6914 Report, Feb 70. 148 p.

Descriptors: *Water supply, *Waste treatment, *Sewage systems, Solid wastes, *Water demand, Community development.
Identifiers: Palm Beach County, Florida.

Part One of this study, which included an inventory of Palm Beach County's water resources, water supply systems, sewerage systems, solid wastes systems, and air pollution control systems, and the legal and administrative aspects of each, was completed and published in six volumes, in 1969. The present report (Part Two) gives, under one cover, a summary of the Part One information. The report also presents an analysis of the inventory results leading into the development of comprehensive plans.
W70-09450

PRELIMINARY WATER AND WASTE MANAGEMENT PLAN.
Sacramento Regional Area Planning Commission, Calif.
For primary bibliographic entry see Field 05D.
W70-09453

A TEST OF FEDERAL WATER PROJECT EVALUATION PROCEDURES WITH EMPHASIS ON REGIONAL INCOME AND ENVIRONMENTAL QUALITY: DETROIT RIVER, TRENTON NAVIGATION CHANNEL,
Michigan State Univ., East Lansing. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 03E.
W70-09497

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

BAY ISLAND DRAINAGE AND LEVEE DIST NO 1 V NUSSBAUM (OPERATION COSTS OF PUMPING FACILITY).

388 Ill 131, 56 NE2d 615-617 (1944).

Descriptors: *Illinois, *Drainage districts, *Pumping, *Administrative agencies, State governments, Costs, Drainage, Surface drainage, Drainage programs, Drainage systems, Pumping plants, Seepage, Surface waters, Controlled drainage, Legislation, Legal aspects, Judicial decisions, Mississippi River, Federal government, Structures, Pumps.

Plaintiff drainage district brought suit against the commissioners of a sub-district for the determination of the amount owed by defendants for its share of operating a pumping plant. Plaintiff contended that under Illinois statutes, costs of such operations were to be shared by adjoining drainage districts on a percentage basis determined by the amount of water each had pumped through the plant. Defendant argued that the federal government, under a plan designed to subsidize adjoining drainage districts with seepage problems, had paid a portion of the amount claimed by plaintiff. Defendant further contended that the percentage figure assigned by plaintiff was too high. Testimony was introduced showing the percentage figure quoted by plaintiff was in fact too high, and evidence concerning the government payments was excluded. A directed verdict for plaintiff was entered. In reversing the trial court, the Supreme Court of Illinois ruled that the question of the percentage should have been given to the jury and that the evidence of government subsidies was improperly excluded. (Barker-Florida)
W70-09155

REQUIREMENTS AND COSTS OF ALTERNATIVE SYSTEMS FOR TREATING PEACH CANNERY WASTES.
Clemson Univ., S.C. Water Resources Research Inst.
G. H. Liner, and J. M. Stepp.
Water Resources Research Institute, Report No. 15, p. 1-75, April 1970. 16 fig, 19 tab, 33 ref. OWRR Project A-002-SC (15).

Descriptors: *Canneries (Peach), *Waste water treatment, *Cost comparisons, Spray irrigation, Oxidation lagoons, Aeration.

Waste water treatment disposal by small seasonal peach canneries was studied, including description of the relevant practices of nine South Carolina canneries in 1966. The technical requirements for oxidation lagoons, aerated lagoons and spray irrigation systems of waste-water disposal by peach canneries of five sizes were studied. The costs of constructing and operating each type and size of facility under South Carolina conditions as of 1967 and the effect of land values upon comparative costs were investigated. Non-land costs per unit of output were lowest for spray irrigation systems for all sizes of canneries, but as assigned land costs were increased to a relatively high level most of the least-cost 'positions' were occupied by aerated lagoons. (Stepp-Clemson)
W70-09183

DESALTING COST CALCULATING PROCEDURES,
Southwest Research Inst., Houston, Tex.
For primary bibliographic entry see Field 03A.
W70-09241

6D. Water Demand

CITY OF NEW YORK V NEW YORK WATER SERVICE CORP (CITY MAY ORDER AN INCREASE IN WATER SUPPLY).
For primary bibliographic entry see Field 03D.
W70-09025

PRELIMINARY WATER AND WASTE MANAGEMENT PLAN.
Sacramento Regional Area Planning Commission, Calif.
For primary bibliographic entry see Field 05D.
W70-09453

6E. Water Law and Institutions

BRITISH WATER POLLUTION CONTROL,
For primary bibliographic entry see Field 05D.
W70-09041

ACKERMAN V TOWNSHIP OF NORTH HUNTINGDON (MUNICIPAL AUTHORITY TO GRANT RIGHTS IN PRIVATELY OWNED SEWER LINE).

261 A2d 570-573 (Penn 1970).

Descriptors: *Pennsylvania, *Local governments, *Sewers, *Pipelines, Waste disposal, Municipal wastes, Domestic wastes, Disposal, Sewage disposal, Cities, Contracts, Legal aspects, Judicial decisions, Public rights, Sewage districts, Remedies, Assessments, Cost sharing, Construction.
Identifiers: *Injunction (Restraining).

Plaintiff developer brought action to enjoin defendant township and another developer from connecting into a sewer line which plaintiff constructed, pursuant to a contract with the township, for his and other developments as part of an overall sewage disposal plan. After the sewer line was completed, but before title passed to the township, the township authorized defendant developer to tap into the line. Plaintiff contended that defendant township had no authority to authorize defendant developer to make use of a sewer line to which the township had no title. Defendants argued that since the sewer was part of an overall plan and since the permits for the line were issued to the township, the township was the owner of the line. The court held that, under the terms of the contract, title to the line was clearly in plaintiff. Therefore, defendant developer was without valid permission to transport sewage through the line. However, the court felt that injunctive relief was improper as it would cause more harm than the interest protected, and remanded the case to assess defendant developer for a proportionate share of the cost of the sewer line. (Liptak-Florida)
W70-09053

HONEBEIN V MONTICELLO (DEED TO LAKE FRONTAGE AS NOT EXTENDING OWNERSHIP TO LAKE BED).

263 App Div 745, 31 NYS2d 532-534 (Sup Ct 1941).

Descriptors: *New York, *Ownership of beds, *Lake beds, *Boundaries (Property), Beds under water, Beds, Real property, Judicial decisions, Legal aspects, Lakes, Docks, Watercourses (Legal), Prescriptive rights, Remedies, Maintenance, Land, Local governments, Water law, Relative rights, Boundary disputes.
Identifiers: Adverse possession.

Plaintiff-grantee to lake front land contended that her deed gave her title to the center of the lake bed abutting her property. Defendant village denied plaintiff's contentions and claimed the deed to plaintiff's lake front land restricted her ownership to the edge of the lake. Defendant also claimed title to the disputed lake bed by adverse possession. The majority of the court held for defendant. The dissenting opinion would have upheld plaintiff's claim of ownership to the center of the lake bed by construction of law, as the description in plaintiff's deed did not expressly restrict her ownership to the edge of the lake nor was the title to the center of the watercourse expressly withheld. Moreover, the dissent stated that defendant's claim of adverse possession was negated by plaintiff's sufficient showing of possession to the lake bed by the maintenance of a dock over the lake waters. (Finman-Florida)
W70-09054

BD OF EDUC V NORTH HEMPSTEAD (NO RIGHT TO DAMAGES FOR NATURAL FLOW OF SURFACE WATERS).

261 App Div 1102, 27 NYS2d 114-115 (Sup Ct 1941).

Descriptors: *New York, *Drainage systems, *Natural flow, *Surface runoff, Surface waters, Drainage engineering, Land, Culverts, Drainage, Contours, Legal aspects, Judicial decisions, Remedies, Damages, Cities, State governments, Overland flow, Pipe flow, Regulated flow, Discharge (Water), Pipes, Maintenance, Rain, Volume, Flow augmentation.

Plaintiff school district's land was naturally contoured so that surface waters flowed over such land into a culvert constructed by the state. Defendant town constructed a catch basin system near plaintiff's land for the drainage of rain and surface waters. Plaintiff sought to restrain defendant from discharging surface waters upon its land and sought damages to such land due to the construction and maintenance of the catch basin system. The appellate court stated that plaintiff had failed to show that defendant's catch basin system, in fact, caused an increased volume of water upon its property. Furthermore, the court noted plaintiff's failure to prove that defendant should have installed larger drain pipes to adequately drain surface waters. Moreover, while defendant might have been liable for an increased volume of surface waters flowing over plaintiff's land due to the construction and maintenance of the catch basin system, it would not be held liable in this case for the natural flow of surface waters over such land. (Finman-Florida)
W70-09055

HOPKINS V UPPER SCIOTO DRAINAGE AND CONSERVANCY DIST (NO DAMAGES FOR IMPROPER MAINTENANCE OF DRAINAGE DISTRICT'S WATERWAYS).

57 Ohio App 505, 37 NE2d 430-432 (1940).

Descriptors: *Ohio, *Drainage districts, *Water injury, *Drainage effects, Administration, Governments, State governments, Maintenance, Ditches, Obstruction to flow, Land, Crops, Drainage systems, Damages, Regulation, Legal aspects, Judicial decisions, Remedies, Conservation, Potatoes, Political aspects, Management, Standards, Legislation.

Defendant drainage and conservancy district, a political subdivision of the state, was alleged to have been negligent in failing to maintain its waterways or ditches in such a manner as to allow the unobstructed flow of water in such district. Plaintiff private landowner sought damages for the destruction of his potato crop which allegedly resulted from defendant's negligent maintenance of its drainage system. Defendant denied its liability for plaintiff's damages. The court noted that defendant was on instrumentality of the state and, in the absence of a statutory provision to the contrary, such instrumentality was not to be held liable for injuries incurred in connection with the exercise of its governmental functions. In view of the fact that the only applicable statutory provision provided that no damages would be allowed if not otherwise allowed in law and expressly prohibited the imposition of any liability for destruction of crops due to improper maintenance of a conservancy district's waterways or ditches, the court ruled that plaintiff was precluded from bringing the action, and dismissed the petition. (Finman-Florida)
W70-09057

VARNEY RIVER DRAINAGE DIST V SPIEDEL (ASSESSMENTS ON LAND HELD BY EQUITABLE TITLE).
152 SW2d 54-58 (Mo 1941).

Descriptors: *Missouri, *Federal government, *Assessments, *Land tenure, Legislation, Drainage districts, State governments, Regions, Local governments, Judicial decisions, Legal aspects, Taxes, Swamps, Land reclamation, Benefits, Economics, Real property, Patents, Proprietary power, United States, Public lands, Federal government.
Identifiers: *Equitable title.

Plaintiff drainage district sought to collect delinquent drainage assessments on defendant's land for improvements made under authority of state law. Defendant contended the assessments against his land were void since the state had no authority to make them. On the basis of the Swamp Land Act of 1850 and a prior case, defendant argued that the United States held title to the land prior to 1933, when the improvements were made thereon. Defendant argued that the Act gave Missouri no legal title to the land which it could convey until it acquired patents to the area from the United States in 1933. Therefore, no tax could be imposed for improvements made on the property while it was legally owned by the United States. The court rejected defendant's contention and held that the Act gave the state of Missouri a beneficial interest in the swampland. When the state legislature donated the land to the counties, a patent from the county to subsequent owners conveyed an existing right, which carried legal title with it when it was officially determined that the swampland fell under the Act. The grantee acquired sufficient equitable title to be subject to assessments for improvements. (Hubener-Florida)
W70-09058

SANDERS V ROSE (PROPERTY BOUNDARY AS AFFECTED BY CHANGE IN COURSE OF STREAM).

296 Ky 25, 176 SW2d 119-122 (1943).

Descriptors: *Kentucky, *Boundaries (Property), *Boundary disputes, *Channels, Legal aspects, Streams, Water law, Water rights, Routing, Judicial decisions, Land tenure, Real property, Prescriptive rights, Adjudication procedure, Avulsion, Relative rights.

Plaintiff and defendant owned adjoining farms, the boundary line between the farms being formed by a creek. A sudden change in the creek's course had moved the thread of the creek approximately 500 feet. Plaintiff sued to quiet title to the land between the old and new locations of the creek, contending that all the deeds in plaintiff's and defendant's chain of title, which established the property line at the creek, referred to the location of the creek prior to the sudden change. Defendant counterclaimed, asking that her title be quieted, and contended that the deed to her father referred to the creek at its new location. On appeal from a judgement for defendant, the court held that the weight of the evidence showed that all of the deeds referred to the channel of the creek as it was prior to the sudden change. The court noted that even if, as the chancellor had found, the deed to defendant's father referred to the creek's new location, defendant would have had to claim adverse possession for the statutory period in order to perfect her title. (Liptak-Florida)
W70-09059

DICKSON V SANDEFUR (DISPUTED OWNERSHIP OF LAND APPEARING AFTER SUDDEN SHIFT IN RIVER'S COURSE).
235 So 2d 579-593 (La Ct App 1970).

Descriptors: *Louisiana, *Avulsion, *Accretion (Legal aspects), *Boundary disputes, Boundaries (Property), Floods, Bank erosion, Land tenure, Real property, Judicial decisions, Legal aspects, Navigable rivers, Sedimentation, River flow, Alluvium, River beds, Soil, River basins, Channel erosion, Channel morphology, Riparian land.
Identifiers: *Re-emergence of lands.

Plaintiff and defendant owned land on opposite sides of a bend in the Red River. After a heavy spring flood the river changed its course. Plaintiff brought a possessory action claiming ownership of land on his side of the river which had appeared after the sudden cutoff by the river. The court gave judgment for plaintiff. Defendant filed a reconventional petitory action claiming ownership of land over which the river had formerly flowed further along the bend. Defendant claimed the land pursuant to a state statute providing that where a river opens a new bed owners of soil newly occupied by the river shall take the former bed. Defendant alleged that the land had appeared by an avulsive action of the river. The court held that defendant failed to sustain the burden of proof in establishing that an avulsive action occurred in the area he claimed. The court found that the land in question had been created by accretion to the opposite bank and such deposit belonged to the owners of those banks. Since the land was found to be the result of accretion, the court also rejected defendant's contention that the lands were subject to the doctrine of re-emergence of land after submergence. (Hubener-Florida)
W70-09060

DALY V NEW YORK (DAMAGES TO CROPS FROM BARGE CANAL CONSTRUCTION).

262 App Div 661, 30 NYS2d 717-720 (1941).

Descriptors: *New York, *New York State Barge Canal, *Flood damage, *Crops, Damages, Flooding, Canals, Surface water, Canal construction, Potatoes, Agriculture, Land use, Judicial decisions, Legal aspects, Water law, Governments, Floods, Floodwater, Water injury, Overflow, Dams, Valleys, Remedies.

Plaintiffs, landowners along a creek which was part of the New York State Barge Canal, brought an action for damages caused by flooding of their lands. Plaintiffs claimed that due to the construction and operation of the Canal, their lands were flooded and their potato crops severely damaged. Defendant claimed that similar damage had occurred prior to the building of the Canal and that the damage complained of was not caused by the Canal. The Supreme Court of New York, Appellate Division, ruled that the evidence was sufficient to show that the flooding was caused by the Canal and that therefore the state was liable for the damage. The judgment of the trial court was affirmed. (Barker-Florida)
W70-09061

IN RE EAST RIVER DRIVE (VALUATION OF SCENIC EASEMENTS IN CONDEMNATION PROCEEDINGS).
264 App Div 555, 35 NYS2d 990-1001 (1942).

Descriptors: *New York, *Condemnation value, *Eminent domain, *Scenic easements, Condemnation, Easements, Legal aspects, Right-of-way, Compensation, Water law, Judicial decisions, Local governments, Riparian rights, Access routes, Real property, Remedies, Property values, Roads, Highways, Embankments, Bridges, Roadbanks, Retaining walls, Concrete structures, Zoning.

Plaintiff city instituted condemnation proceedings to obtain river frontage for construction of a concrete, triple-deck viaduct. Defendant coal yard operator, who owned land located along the river, received damages for land taken, riparian rights and destruction of improvements, but contended that he was also entitled to consequential damages to the residue because the land was no longer suitable for apartments, which was conceded to be the 'best use' of the land, the viaduct having obstructed the view of the river. Co-defendant apartment owner received damages for the destruction of his riparian rights and consequential damages for obstruction of his easement of view, but contended that the consequential damages were inadequate. Plaintiff contended that, as to the coal yard, there was no damage to the improvements since a coal yard was an inadequate use of property zoned for apartments. As to the defendant apartment owner, plaintiff contended that there was no consequential damage since none of the apartment owner's property was taken. The court held, as to defendant coal yard operator, that damages were proper where the present business use was destroyed, notwithstanding that such use was not the best use of the property. As to defendant apartment owner, the court held that real property included easements and riparian rights and that a taking thereof necessitated consequential damages. (Liptak-Florida)
W70-09062

NIAGARA FALLS POWER CO V DURYEA (RIGHT OF STATE TO CHARGE FOR WATER USE).
57 NYS 2d 777-787 (Sup Ct 1945).

Descriptors: *New York, *Hydroelectric power, *Public rights, *Preferences (Water rights), Relative rights, Water rights, Riparian rights, Water utilization, Diversion, Navigable rivers, Water policy, Legislation, Water resources, Water costs, Electric power industry, Administrative agencies, Competing uses, Judicial decisions, Legal aspects, Eminent domain, Beds under water, Ownership of beds, Governments.

Plaintiff power company brought suit against the Water Power and Control Commission of New York to have a statute nullified. The statute imposed a rental on water rights which plaintiff claimed as a previously acquired vested property right. Through a series of earlier statutes, plaintiff had been granted the rights to divert water from the Niagara River and now claimed that the Commission could not charge for such rights. Defendant claimed the right to charge rental for the diverted waters through the power of the state over navigable public waters. The Supreme Court of New York found that the Niagara River was a natural resource of the state and that the state had the power to preserve to the public the energy of the river regardless of any rights in private interests it may have previously created or allowed. The statute was designed expressly for the preservation of the public rights to the water, and thus the state could validly charge for diversion thereof. (Barker-Florida)
W70-09063

JAMES V DRAVO CONTRACTING CO (STATE'S RIGHT TO TAX FEDERAL GOVERNMENT'S CONTRACTORS).
302 US 134, 58 S Ct 208-233 (1937).

Descriptors: *West Virginia, *Taxes, *Dam construction, *Federal government, Damsites, Federal reclamation law, Federal jurisdiction, State jurisdiction, Legislation, Permits, Regulation, Judicial decisions, Governments, State governments, Legal aspects, Contracts, Navigable rivers, Ownership of beds, Jurisdiction, Navigation.

West Virginia imposed a tax upon the gross receipts of respondent contractor for construction work done for the United States on dams and locks of a navigable river in West Virginia. Respondent brought suit to restrain the tax. The district court granted a permanent injunction against the tax. On appeal the United States Supreme Court held the questions presented were: (1) whether the state had territorial jurisdiction to impose the tax; (2) whether the tax placed an invalid burden on the federal government. The Court held that West Virginia could not impose a tax on work done by respondent outside of the state. Also, no tax could be imposed on work on any West Virginia site over which the United States retained exclusive jurisdiction. Exclusive jurisdiction did not mean the paramount authority of the United States over certain lands and rivers to provide for navigational or other improvements. The Court determined that the United States had not retained exclusive jurisdiction over the damsites in question. Since the tax was not imposed upon a government instrumentality, it did not present an intolerable burden. Therefore, the Court reversed the district court and upheld the tax. (Hubener-Florida)
W70-09064

HINDERLIDER V LA PLATA RIVER AND CHERRY CREEK DITCH CO (EQUITABLE APPORTIONMENT OF INTERSTATE STREAM THROUGH USE OF INTERSTATE COMPACT).
304 US 92, 58 S Ct 803-811 (1938).

Descriptors: *Equitable apportionment, *Interstate rivers, *Interstate compacts, *Prior appropriation, Appropriation, Diversion, Beneficial use, Proration, Streams, Adjudication procedure, Water rights, Water law, Judicial decisions, Water allocation (Policy), Federal jurisdiction, State jurisdiction, Irrigation water, Non-navigable streams, Priorities, Preferences (Water rights), State governments, Federal government, Water policy, Legal aspects, Relative rights.
Identifiers: *Injuction (Mandatory).

Plaintiff Colorado ditch company sought a mandatory injunction to restrain defendant state engineer of Colorado from depriving plaintiff of water used for irrigation. Plaintiff contended that its right to appropriate the water from an interstate stream had been established in prior state proceedings. Defendant contended that his water management policy was governed not by the prior proceedings, but by a river compact made by Colorado and New Mexico and ratified by Congress. Reversing the state court decision for plaintiff, the Supreme Court of the United States held that water in interstate streams must be equitably apportioned between states. Therefore, the state court proceeding was not res judicata with respect to the water rights of citizens of Colorado, since the state could only apportion to its citizens rights which represented the state's equitable share of the water in the stream. The terms of the compact were binding upon all claimants to water rights in those states that were parties to the compact. (Liptak-Florida)
W70-09065

ARIZONA V CALIFORNIA (RELATIVE RIGHTS IN COLORADO RIVER WATER).

298 US 558, 56 S Ct 848-855 (1936).

Descriptors: *Arizona, *California, *Appropriation, *Colorado River, Water rights, Prior appropriation, Equitable apportionment, Federal jurisdiction, Federal-State water rights, Conflicts, Legal aspects, Judicial decisions, Relative rights, State jurisdiction, Water law, Interstate rivers, Navigable rivers, Navigation, Adjudication procedure, Diversion, Preferences (Water rights).
Identifiers: *Boulder Canyon Project Act.

Arizona filed a suit against California and all other states of the Colorado River Basin seeking: (1) that Arizona's equitable share of Colorado River water, subject to diversion and use, be fixed by the Court; (2) that California be barred from claiming and using more than an equitable share of the river water not to exceed the limit imposed by the Boulder Canyon Project Act; (3) a decree that diversion and use of any of Arizona's share by a defendant state did not confer an appropriative right on the diverting state; and (4) that Mexico's equitable share be supplied from California's equitable share. The United States Supreme Court held that Arizona could not act to exempt available water from appropriation until such time as the other state might want to appropriate it. A justiciable controversy would be presented only if Arizona had present rights in the unappropriated water. The court dismissed the suit on the ground that the United States, which was not a party, had a paramount power to control the unappropriated waters for the purpose of improving navigation. The United States was an indispensable party in whose absence the water could not be apportioned. (Hubener-Florida)
W70-09066

ICKES V FOX (INCREASED WATER RATES IMPOSED CONTRARY TO LAW).

300 US 82, 57 S Ct 412-418 (1937).

Descriptors: *United States, *Federal reclamation law, *Water rates, *Remedies, Water utilization, Water users, Costs, Water distribution (Applied), Water rights, Administrative agencies, Federal jurisdiction, Irrigated land, Water contracts, Relative rights, Judicial decisions, Legal aspects, Beneficial use, Irrigation water, Construction, Federal government, Taxes, Washington, Adjudication procedure.
Identifiers: *Injunction.

Plaintiff landowners created a water user association and included their lands within a reclamation project under the Reclamation Act of 1902. The association entered into a contract with the United States to provide construction of irrigation works pursuant to the Act. The amount of water used by each member was to be determined by the government based upon the beneficial use of the water to such land. An act of Congress was passed providing that no increase of construction charges would be made except by special agreement with a majority of the water users. To finance expansion of irrigation works, the government sought to increase the charges for the use of the water without such agreement. Plaintiff landowners brought suit to enjoin the Secretary of the Interior from enforcing the increased water rates. Plaintiffs contended such increase would deprive them of their vested rights in the water. The federal government contended that it was an indispensable party whose sovereign immunity had not been waived. The court held that the exemption of the United States from liability did not protect its officers in their individual capacity, and in the case of an injury threatened by the Secretary's illegal action, he could not claim immunity from the injunctive process. (Barnett-Florida)
W70-09067

UNITED STATES V SPONENBARGER (ALLEGED TAKING OF PRIVATE PROPERTY WITHOUT JUST COMPENSATION VIA FLOOD CONTROL PLAN).

308 US 256, 60 S Ct 225-231 (1939).

Descriptors: *Arkansas, *Eminent domain, *Levees, *Floodways, Channel improvement, Flood control, Flood protection, Flood routing, Floodproofing, Flow control, River regulation, Routing, Water control, Diversion structures, Cutoffs, Flood damage, Spillways, Spillway crests, Watercourses (Legal), Mississippi River, Legislation, Judicial decisions, Legal aspects, Damages, Compensation.

Plaintiff brought action against the United States to recover compensation for the alleged taking of land resulting from the Mississippi Flood Control Act of 1928. Plaintiff's property was within a proposed floodway authorized by the Act. Plaintiff alleged that the mere fact the Act was in effect imposed a

servitude on her land for the purpose of intentional future flooding. Plaintiff further contended that her right of self-defense against floods through locally built levees was taken away the the 1928 Act. The Supreme Court, in holding for the United States, found that plaintiff's land was situated in the natural floodway of the Mississippi River and had not been subjected to any servitude from excessive floodwaters which had not already existed prior to 1928, and that her property had actually benefited by the government's impoundments. Furthermore, the mere possibility her land might be flooded, which possibility existed before the government's project, did not constitute the taking of private property without just compensation. The Court rejected the contention that the Act imposed a servitude for future flooding since the proposed flooding might never occur, especially since the construction of the floodway in question had been abandoned. Finally, the Court held that no right of self-defense against floods had been taken as the United States had not yet built or acquired levees as authorized by the Act. (Price-Florida)
W70-09068

DANFORTH V UNITED STATES (COMPENSATION FOR TAKING OF PRIVATE PROPERTY).
308 US 271, 60 S Ct 231-237 (1939).

Descriptors: *Missouri, *Compensation, *Condemnation value, *Eminent domain, Condemnation, Right-fo-way, Federal jurisdiction, Federal government, Levees, Flood control, Easements, Mississippi River, Floodways, Drainage, Diversion, Diversion structures, Legislation, Spillways, Legal aspects, Judicial decisions.

Defendant landowner brought certiorari to review a district court and circuit court of appeals decision in favor of petitioner United States in a condemnation suit. Defendant had been awarded for land flooded by petitioner compensation less in amount than was agreed to by the parties prior to the suit. Moreover, defendant objected to the fact that no provision was made as to the interest to be paid thereon. The United States Supreme Court held that the amount agreed to by the parties was binding in that the offer had been accepted prior to the government's attempt to withdraw the offer. However, the time of the taking of the property is when compensation is paid unless taking occurs prior thereto in actuality or by statutory provision. Therefore, no interest had accrued on the amount agreed upon. The decree was affirmed in part and reversed in part. (Price-Florida)
W70-09069

YEARSLEY V W A ROSS CONST CO (LIABILITY OF PRIVATE CORPORATION ACTING PURSUANT TO AN ACT OF CONGRESS).
309 US 18, 60 S Ct 413-415 (1940).

Descriptors: *Accelerated erosion, *Channel improvement, *Compensation, *Legislation, Nebraska, Accretion (Legal aspects), Bank erosion, Erosion, Soil erosion, Damages, Alteration of flow, Navigable waters, Navigable rivers, Missouri River, Channel morphology, Dikes, Legal aspects, Judicial decisions, Riparian waters, Riparian land, Federal government.

Defendant construction company had built dikes in the Missouri River and, using large boats with paddles and pumps, had produced artificial erosion of part of plaintiffs' land. Plaintiff landowners sought to recover damages. Defendant alleged that the work was done pursuant to contract with the United States government, as authorized by an act of Congress. Defendant further alleged that its actions had only hastened the inevitable and were done to improve the navigation of the river. Plaintiff contended that the contract did not contemplate the taking of property without just compensation in violation of the fifth amendment. A decree for plaintiff was reversed in the circuit court. The Supreme Court held that since the act was done pursuant to an act of Congress, defendant could incur no liability. If plaintiff's fifth amendment rights had been violated, the government had impliedly promised to pay, and a suit in the court of claims was the appropriate remedy. Plaintiffs' remedy was against the government, and not against its representative. The judgment of the circuit court was affirmed. (Price-Florida)
W70-09070

OKLAHOMA EX REL PHILLIPS V GUY F ATKINSON CO (INJUNCTION AGAINST DAM CONSTRUCTION).
313 US 508, 61 S Ct 1050-1064 (1941).

Descriptors: *Oklahoma, *United States, *Dams, *Navigation, Eminent domain, Governments, Flood control, Damsites, Dam design, Maximum probable flood, Reservoirs, Water control, Multiple-purpose projects, Hydroelectric power, Economics, Navigable rivers, Mississippi River Basin, Regions, Interstate, Costs, Legislation, Judicial decisions, Legal aspects, Project planning, Relative rights.
Identifiers: *Red River.

Oaklahoma brought a suit seeking to enjoin construction of a dam on the Red River by the United States. The state contended that the resulting reservoir would innundate a large tract of land and would thus interfere with existing public and private interests in the land. The state further claimed that the Red River was non-navigable in the proposed area, that Congress had no power over the water, and that the dam was a multiple-purpose project. Defendant argued that the dam was part of an overall scheme to protect the Mississippi River Basin, that the navigable portion of the Red River would be benefited and that the income derived from the sale of power from the dam operation would help finance the over-all project. The U. S. Supreme Court ruled that Congress has authority through the power over the waters of a river if any part of it is navigable and that the flood control program was part of the commerce power. The fact that ends other than flood control would result from an exercise of the commerce power would not invalidate that exercise. The injunction was denied. (Barker-Fla)
W70-09071

PUERTO RICO V RUSSELL AND CO (IMPOSED TAX AS IMPAIRMENT OF CONTRACT FOR WATER SUPPLY).

315 US 610, 62 S Ct 784-791 (1942).

Descriptors: *Puerto Rico, *Contracts, *Taxes, *Supply contracts, Water delivery, Irrigation systems, Drainage districts, Riparian rights, Governments, Assessments, Costs, Operating costs, Dams, Relative rights, Water costs, Water supply, Water distribution (Applied), Competing uses, Water rights, Judicial decisions, Legal aspects, Water policy, Water demand, Supervisory control (Power).
Identifiers: *Constitutionality.

Puerto Rico brought an action to collect taxes imposed on lands of defendant, who was using water from a public irrigation system. When the dam which was part of the system was constructed, riparian owners below the dam site, whose lands were not within the drainage district, were offered contracts for delivery of water in return for their giving up their rights to the water to be used in the irrigation system. Defendant's predecessor has accepted such a contract, and defendant argued that if a tax were imposed on his land for the water use, the obligation of contract would be impared. Puerto Rico argued that the contract entered into was beyond the authority of the commissioner of the drainage district. The United States Supreme Court ruled that where a tax is imposed on land outside of a drainage district on water use stemming from a contract for delivery of such water in consideration of suspension of water rights, such a tax is an impairment of contract. It was also held that the commissioner was empowered by statute to make such contracts. (Barker-Fla)
W70-09072

UNITED STATES V WILLOW RIVER POWER CO (IMPAIRED EFFICIENCY OF HYDROELECTRIC PLANT CAUSED BY RAISING THE WATER LEVEL OF THE RIVER ON WHICH IT WAS LOCATED).

324 US 499, 65 S Ct 761-770 (1945).

Descriptors: *United States, *Hydroelectric plants, *Compensation, *Riparian rights, Public utilities, Condemnation value, Non-navigable waters, Eminent domain, Rivers, Judicial decisions, Legal aspects, Dams, Riparian land, Wisconsin, Electric power production, Power head, Navigable waters, Tailwater, High water mark, Federal government, Federal jurisdiction, Property values, Reasonable use, Ownership of beds, Usufructuary rights, Relative rights.

Plaintiff power company erected a dam on a navigable river appurtenant to its riparian lands. The dam enabled the company to generate a greater power head. At a later date, defendant United States built a dam downstream from plaintiff for the purpose of aiding navigation. This dam increased the water level of the river and thus decreased plaintiff's power head. Plaintiff brought action to recover compensation for the impaired efficiency of its hydroelectric plant caused by defendant's actions. Plaintiff alleged that such action was a 'taking' of private property for which just compensation was required. The court of claims found the loss of power to be a property right for which a 'taking' by the government must be compensated. The United States Supreme Court reversed, and held that the fundamental principle of riparian rights is that each riparian proprietor has an equal right to make reasonable use of the waters. However, such right on a navigable stream is subject to a dominant public interest in navigation. Thus, in the instant case, no property right was taken, and no compensation was recoverable. (Barnett-Fla)
W70-09073

UNITED STATES V DICKINSON (EMINENT DOMAIN BY RAISING LEVEL OF RIVER PURSUANT TO CONSTRUCTION OF DAM).
152 F2d 865-871 (4th Cir 1946).

Descriptors: *Eminent domain, *Dams, *Backwater, *Condemnation value, Erosion, Legal aspects, Engineering structures, Damages, Flood damage, Rivers, Navigable rivers, Riparian land, Navigation, Relative rights, Floods, Federal government, United States, Judicial decisions, Water levels, Compensation, Real property.

In an action for damages, plaintiff contended that the raising of the water level of a river by the construction of a dam had permanently submerged a portion of his land and had caused the remaining, unsubmerged land to be damaged by erosion so as to constitute a taking of property entitling plaintiff to compensation. Defendant federal government contended that the suit was barred by a statute of limitation and in the alternative admitted liability for the submerged land but contended that the damages to the unsubmerged land did not constitute a taking of property in that the damages were consequential resulting from the exercise of a paramount governmental power to improve navigation. The court held that the suit was not barred in that the action accrued when the water level was finally established and not when the level was initially raised. The court ruled that the defendant was liable for damages to the unsubmerged land in that when part of an owner's land is completely taken, he is entitled not only to compensation therefore but also to compensation for any damage occassioned to his remaining land. (Snow-Fla)
W70-09074

DUKE POWER CO V TOMS (POWER COMPANY'S RIGHT TO FLOOD ACCOMPANIED BY DUTY TO PAY DAMAGES).
118 F2d 443-449 (4th Cir 1941).

Descriptors: *North Carolina, *Easements, *Dam construction, *Compensation, Power operation and maintenance, Electric power, Electric powerplants, Damages, Construction, Flooding, Judicial decisions, Legal aspects, Maintenance, Floods, Remedies, Public utilities, Dams, River flow, Rivers, Obstruction to flow, Underground, Mining, Mineralogy, Flow, Eminent domain.
Identifiers: *Mineral rights.

Defendant electric power company constructed a power dam which partially impounded the waters of a river. As a result, a portion of the lands in which plaintiffs held mineral rights became flooded. Plaintiffs claimed that this flooding had interfered with their right of access to the minerals below the surface, and that this amounted to the taking of property without just compensation. Defendant asserted its right as a public service corporation to maintain its dam and flood the land in which plaintiffs claimed mineral interests. Plaintiffs brought action to quiet title to the lands in controversy. The court noted that this action was basically concerned with defendant's acquisition of an easement of flowage which interfered with plaintiffs' easement of access. The court held that as defendant was a public service corporation which enjoyed the right of eminent domain, it was entitled to maintain its dam and flood the lands in controversy, even though this might interfere with plaintiffs' right of access to the minerals contained below the surface of the lands. However, the court stated that plaintiffs had a right to any permanent damages which resulted from the flooding. (Finman-Fla)
W70-09075

KUHN V CHESAPEAKE AND O RY (EFFECT OF CHANGE OF NATURAL WATERCOURSE ON PROPERTY BOUNDARIES).

118 F2d 400-405 (4th Cir 1941).

Descriptors: *Boundaries (Property), *Boundary disputes, *Channel flow, *Alteration of flow, Judicial decisions, Land tenure, Legal aspects, Natural flow doctrine, Proprietary power, Relative rights, Riparian land, Riparian rights, Riparian waters, Watercourses (Legal), Islands, Rivers, River flow, River beds, Channels, Streams, Deflection, Diversion.

The land in controversy consisted of about 9 acres which had formerly been an island between 2 branches of a river which, by deed from a common grantor, formed the boundary between plaintiff's and defendants' land. Neither party's deed contained a reference to the island. In the course of a flood, the right branch of the river filled with earth and debris and dried up. Both parties claimed title to the land which had formerly constituted the island. The trial court instructed the jury that the channel which they found to have been the main one before the flood would constitute the proper boundary. The circuit court of appeals reversed, stating that a determination of which of the channels was the main one was a significant factor to be considered by the jury in ascertaining the proper boundary, but it should not have been singled out as the sole factor for consideration. (Clarke-Fla)
W70-09076

CARTER OIL CO V WATSON (BOUNDARY DISPUTE WHERE LAND CONVEYED BORDERED ON A STREAM).
116 F2d 195-198 (7th Cir 1940).

Descriptors: *Illinois, *Boundary disputes, *Boundaries (Property), *Ownership of beds, Judicial decisions, Legal aspects, Land tenure, Riparian land, River beds, Water law, Oil industry, Oil wells, Gases, Watercourses (Legal), Streambeds, Streams.

Plaintiff oil company sought to enjoin defendant from drilling for oil and gas on property to which both plaintiff and defendant claimed title. Plaintiff relied on a 1905 deed which he contended gave him title to the land to the middle of the creek adjacent thereto. Defendant contended the deed conveyed the property only to the bank of the creek. To avoid the well settled law that a grant of land bordering on a river carries with it title to the center of the stream, defendant relied on the working of his deed. He argued that the terms of the grant showed an intention to set the boundary at the stream's edge, especially since streams are often referred to in deeds as monuments and are regarded as such when the land conveyed abutts upon them. The appellate court held that, although the language of the deed was awkward, the intention of the parties was clear. The boundary line was the middle of the creek. Consideration of extrinsic evidence, along with the language of the deed, supported this conclusion. The lower court decision for the plaintiff was affirmed. (Price-Fla)
W70-09077

BABCOCK V MISSISSIPPI RIVER POWER CO (INJURY TO LAND VIA DAM CONSTRUCTION).
113 F2d 398-400 (7th Cir 1940).

Descriptors: *Illinois, *Impounded waters, *Flood damage, *Compensation, Impoundments, Flooding, Cultivated lands, Drainage, Damages, Flood protection, Flow control, Floodwater, Floodways, Dams, Judicial decisions, Legal aspects, Land use, Legislation, Water distribution (Applied), Water spreading, Watershed management, Water storage, Water works, Mississippi River, Overflow.

Plaintiff landowner brought action against defendant power company to recover for flood and overflow damages which resulted from the erection of a dam, pursuant to an act of congress, across the Mississippi River. As a result of defendant's dam, part of plaintiff's land, which was leased for the purpose of farming, was rendered useless for cultivation. Plaintiff sought to recover only for recurring and intermittent damages. The court determined the cause of action stated by plaintiff resided only in the lessee of his lands. Plaintiff would have had a cause of action for permanent damages, but had not sought such. The granting of the motion to dismiss was affirmed. (Price-Fla)
W70-09078

FLORIDA BLUE RIDGE CORP V TENNESSEE ELECTRIC POWER CO (RELATIVE RIGHTS IN PROPERTY SUBJECT TO EASEMENTS).
106 F2d 912-916 (5th Cir 1939).

Descriptors: *Georgia, *Electric powerplants, *Easements, *Condemnation, Public utilities, Electric power, Electric power industry, Judicial decisions, Legal aspects, Right-of-way, Water utilization, Land tenure, Real property, Flow control, Industrial water, Land use, Lakes, Dams, Backwater, Water levels, Overflow.

Plaintiff corporation brought action against defendant power company to have flowage easements over plaintiff's land in Georgia declared abandoned and to obtain an injunction against trespass by defendant. Plaintiff contended that: (1) the original transfer of the easements to defendant by another corporation was void; (2) defendant, in acquiring the easements, had really acquired a franchise to sell electricity which was not transferable under public utility regulations; and (3) the easements had ceased when conveyed to defendant because they had been created by condemnation and the condemnor was now a dissolved corporation. The court held for defendant, stating that the transfer of the easements had complied with Georgia law. Further, the corporate charter gave the transferor the usual power to sell any or all of its property; this would include the easements in issue. The taking of the easement by condemnation was perpetual unless otherwise provided for, and compensation for lands overflowed was presumably paid. Moreover, the state was the only proper party to attach th sale of the easement on the allegation that it su pressed competition in violation of public polic (Hubener-Fla)
W70-09079

FRANKLIN V UNITED STATES (CONSEQUEN TIAL DAMAGE FROM FEDERAL DIKE CO STRUCTION IN IMPROVEMENT OF NAVIGA TION).
101 F2d 459-469 (6th Cir 1939).

Descriptors: *Dikes, *Alteration of flow, *Dive sion, *Erosion, Barriers, Diversion structure Flood control, Beds, River beds, Channel erosio Ownership of beds, Rivers, Mississippi Rive Navigable rivers, Judicial decisions, Navigatio Bank erosion, Riparian land, Riparian rights, O struction to flow, Relative rights, Natural flo Federal government, United States.

Plaintiff riparian landowners brought action f damages, and contended that defendant Unite States, by the construction of a dike, had diverte the natural flow of the current of the Mississip River and that as a result of such change of curre plaintiffs' lands were washed away. Plaintif further contended that such constituted a taking lands for a public use so as to require compensatio under the fifth amendment. Defendant contende that the diversion of the current by the dike was improve navigation of a navigable river and was th exercise of a dominant right of the government that regard, and as such there was no taking of pr perty within the purview of the fifth amendmen The court held that defendant was not responsibl to riparian owners for consequential damages fro the deflection of waters by structures lawfully co structed in the aid of navigation. Such damages a not a taking of property in that there is no direct i vasion of the riparian's lands, such lands being su ordinate to the public right of navigation. (Sno Fla)
W70-09080

PIKE RAPIDS POWER CO V MINNEAPOLIS S P AND S S M RY (RELATIVE RIGHTS T RIVER BED AS BETWEEN BRIDGE OWNE AND DAM OWNER).
99 F2d 902-917 (8th Cir 1938).

Descriptors: *Ownership of beds, *Bridge *Navigable waters, *Eminent domain, Dams, Rela tive rights, Navigable rivers, Rivers, River bed Navigation, Riparian rights, Railroads, Damsite Judicial decisions, Riparian land, Beds, Right-o way, State jurisdiction, Land tenure, Federa government, Minnesota, Legal aspects, Condemna tion, Compensation.

In an action to enjoin defendant railroad compan from constructing a bridge over a navigable rive plaintiff power company contended that it, as riparian landowner, had the riparian right to th use of the river bed upon which the bridge was t rest. Defendant, having been vested by state la with the power of eminent domain, converted th action into one for condemnation of plaintiff lands and attendant riparian rights to the use of th beds. The question was whether or not the defe dant had to compensate plaintiff for the propert condemned. The defendant contended that by vi tue of having obtained permission from the federa government to construct the bridge it had a superi or right to the use of the beds and owed no com pensation. The court held that the federal govern ment's paramount right to regulate navigatio rendered riparian rights in navigable rivers servien to the federal rights. However, the granting of per mission to build a bridge was not an exercise o such plenary power. Thus, the taking of plaintiff property and riparian rights through eminen domain required just compensation. (Snow-Fla)
W70-09081

THOMAS B BISHOP CO V SANTA BARBARA COUNTY (MEANDER LINES AS BOUNDARIES).
96 F2d 198-203 (9th Cir 1938).

Descriptors: *California, *Boundaries (Property), *Patents, *Meanders, Boundary disputes, Judicial decisions, Legal aspects, Land tenure, Public benefits, Public rights, Seashores, High water mark, Low water mark, Sand pits, Surveys, Estimating, Mapping, Topography, Real property.

Plaintiff brought action in ejectment to recover land claimed to have been included in a patent to plaintiffs' predecessor by the United States. Defendant county contended: (1) that the land was part of the public domain as it was not on the Surveyor General's plat, and (2) that the meander lines thereon constituted the boundaries of the land patented. Plaintiff asserted that the survey of the land included in the patent stated that the land was bounded by the seashore. The court stated that meander lines are not boundary lines. In reversing the trial court's judgment for defendant, the court held that the true boundary of the land patented was the seashore and not the meander lines as there was no evidence to affirmatively disclose an intention to limit the grant to actual traverse lines. Seaward projections from the survey lines constitute part of the patented land, and the land here involved was such a projection. (Price-Fla)
W70-09082

VERDE RIVER IRRIGATION AND POWER DIST V SALT RIVER VALLEY WATER USERS' ASS'N (CONTRACTUAL RIGHTS TO DAMSITE).
94 F2d 936-941 (9th Cir 1938).

Descriptors: *Arizona, *Damsites, *United States, *Relative rights, Dams, Dam construction, Reservoirs, Water supply, Ditches, Irrigation districts, Diversion, Water utilization, Water users, Hydroelectric power, Easements, Right-of-way, Surveys, Contracts, Grants, Judicial decisions, Legal aspects, Irrigation ditches.

Plaintiff irrigation district had been granted rights-of-way to build dams in certain locations along a river. Such grants required submission of maps of the proposed damsites to the Secretary of the Interior for approval. Plaintiff contended that a dam which defendant had contracted to erect was to be built on a site previously included in the grant to plaintiff, and therefore plaintiff sought validation of his easements and a voiding of defendant's contract. Defendant argued that no map of the disputed site was submitted to the Secretary of the Interior for approval, and therefore plaintiff had acquired no rights in the specific area. The Ninth Circuit Court of Appeals ruled that since no map of the exact location had been presented, the Secretary could not have approved the grant of that site to the plaintiff. Therefore plaintiff had acquired no rights in the location, and defendant's contract for dam construction was valid. (Barker-Fla)
W70-09083

UNITED STATES V WABASHA-NELSON BRIDGE CO (COMPENSATION FOR CONSEQUENTIAL DAMAGES TO CONDEMNED RIGHT-OF-WAY).
83 F2d 852-856 (7th Cir 1936).

Descriptors: *Dams, *Right-of-way, *Water levels, *Condemnation value, United States, Condemnation, Engineering structures, Bridges, Rivers, Access routes, Easements, Eminent domain, Legal aspects, Compensation, Federal government, Percolation, Capillary conductivity, Judicial decisions, Damages, River training, Navigable rivers, Mississippi River, Relative rights.

In a condemnation proceeding, plaintiff United States, pursuant to plans to construct a dam, sought to obtain flowage easements upstream. Defendant bridge company's right-of-way, a roadway embankment leading to a bridge, was subject to such flowage easements in that the water level on the embankment would be raised. Defendant contended that the establishment of such an easement would constitute a taking of property and that the raised water level would, through percolation and capillary attraction, damage all of the roadway so as to entitle defendant to additional compensation. Plaintiff contended that it was liable only for the portion of the roadway actually invaded by the raised water level and that any other damages were merely consequential and thus not subject to compensation. The court held that where a portion of property is actually taken, the owner is entitled to compensation for the portion actually taken and for damages to the remainder of the land attendant to such taking. Thus defendant was entitled to compensation for damages to the entire roadway. (Snow-Fla)
W70-09084

MCALLISTER V SLOAN (FLOODING OF PROPERTY DUE TO DAM CONSTRUCTION).
81 F2d 707-711 (8th Cir 1936).

Descriptors: *Arkansas, *Flood damage, *Damsites, *Dam construction, Adjudication procedure, Judicial decisions, Legal aspects, Riparian land, Riparian waters, Riparian rights, Federal jurisdiction, Backwater, Damages, Compensation, Real property, Water injury, Flooding.

Plaintiff landowners sought double damages for injury to their land by flooding which resulted from defendant's construction of a dam below their property. Defendant was granted a directed verdict in the trial court. The Circuit Court of Appeals, Eighth Circuit, reversed, holding that plaintiffs' complaint had stated a common law cause of action for flooding of their lands, and that the complaint should not have been dismissed on mere technicalities. A new trial was ordered. (Price-Fla)
W70-09085

NE-BO-SHONE ASS'N, INC V HOGARTH (PUBLIC FISHING RIGHTS IN NAVIGABLE RIVERS).
81 F2d 70-73 (6th Cir 1936).

Descriptors: *Michigan, *Fishing, *Public rights, *Navigable rivers, Rivers, Beds, River beds, Navigable waters, Navigation, Ownership of beds, Riparian rights, Relative rights, Boating, Judicial decisions, Recreation, Sport fishing, Legal aspects, Usufructuary right, Non-navigable waters.

Plaintiff, owner of property through which a river ran, brought an action to have his rights in such river established and to have an injunction issued to stop various members of the public from fishing upon such river. Plaintiff contended that the stream was not navigable and that the public thus had no rights in such river since he, as owner of the bed of the river, held exclusive rights to the river. Defendants contended that the river was of a public character and consequently there existed a right of the public to fish therein. The court found that the river, though not navigable as to boats, had previously been used to float logs, thus establishing the river as capable of being used for the purposes of commerce and thus qualifying such river as public waters. The court recognized that plaintiff was the owner of the bed of the river by virtue of being the owner of the land which it traversed but held that if waters are public for any purpose, they are public for all purposes so as to establish a public fishing right in the river. (Snow-Fla)
W70-09086

PALM BEACH COUNTY V SOUTH FLORIDA CONSERVANCY DIST (DRAINAGE DISTRICT'S USE OF LEVEE FOR CONSERVATION PARAMOUNT TO COUNTY'S USE AS A PUBLIC ROAD).
170 So 630-633 (Fla 1936).

Descriptors: *Florida, *Drainage districts, *Levees, *Right-of-way, Roads, Local governments, Legislation, Prescriptive rights, Legal aspects, Judicial decisions, Water law, Public rights, Water resources development, Easements, Administrative agencies, Real property, Public lands, Land reclamation, Canals, Transportation, Water conservation, Canal embankments, State governments, Relative rights.

Plaintiff drainage district brought suit to enjoin defendant county commission from interfering with the reconstruction of a levee. Plaintiff had constructed the levee along a canal in 1917 and in 1921 it was leveled and used as a public road. When plaintiff began to raise the height of the levee, defendant had plaintiff's officers arrested and charged with obstructing a county highway. Although plaintiff had originally built the levee, defendant contended that state law provided that any road maintained by a county for four years shall be considered dedicated to the public. Plaintiff argued that reconstruction of the levee was necessary for proper drainage and reclamation. Affirming the trial court's judgment for plaintiff, the court held that the statute providing for dedication of roads after the statutory period was not intended to divest public bodies, such as plaintiff drainage district, of rights-of-way acquired for public purposes in accordance with the law. Furthermore, the court pointed out that, while the road could be built elsewhere, the levee would be constructed in no other place. (Liptak-Fla)
W70-09087

BROWN V NORTH ST LUCIE RIVER DRAINAGE DIST (DUTY OF LANDOWNERS TO MAINTAIN LATERALS CONNECTING TO DITCH OF DRAINAGE DISTRICT).
10 So 2d 910-913 (Fla 1943).

Descriptors: *Florida, *Drainage districts, *Laterals, Easements, Ditches, Locks, Relative rights, Legal aspects, Judicial decisions, Flow control, Engineering structures, Drainage systems, Flood damage, Overflow, Local governments, Dikes, Dams, Flood control, Surface waters, Maintenance, Repairing.
Identifiers: *Injunction.

Plaintiff landowners outside defendant drainage district were granted an easement by defendant to utilize the drainage ditches of the district provided owners properly maintained the laterals which would be constructed to tie in with the ditches. A lock constructed to control the flow of water from plaintiffs' ditches was damaged so that water flowed uncontrolled into the district causing flood damage. Defendant district threatened to construct a dam to cut off all flow from plaintiffs' ditches. Even though plaintiffs agreed to repair the lock, defendant began to build a dam. Plaintiffs' sought an injunction against construction of the dam. The lower court denied the injunction. The Florida supreme court held that the original contract granting the easement controlled the rights and responsibilities of the parties. The court modified the lower court decree so that plaintiffs would be able to renew their application when they could show they were maintaining the locks, laterals and ditches so as not to cause overflow or harm to lands in the drainage district. (Hubener-Fla)
W70-09088

TROUT BROOK CO V WILLOW RIVER POWER CO (LIABILITY FOR DAM FAILURE DURING UNPRECEDENTED FLOOD).

267 NW 302-306 (Wis 1936).

Descriptors: *Wisconsin, *Dam failure, *Flood damage, *Maximum probable flood, Riparian rights, Riparian land, Water rights, Water law, Legal aspects, Judicial decisions, Damages, Remedies, Floods, Dams, Concrete dams, Earth dams, Mill dams, Flood control, Flood protection, Floodgates, Historic flood, Non-navigable waters,

Rivers, River flow, Hydroelectric plants, Trout, Ponds.

Plaintiff riparian landowner brought action against defendant power company, alleging that defendant's negligent operation of its dams during a flood caused one of the dams to break, thereby damaging plaintiff's trout ponds. Plaintiff contended that defendant was required to provide for adequate passage of water through its dams at all times to prevent injury to riparian owners, and that the dams upstream from plaintiff's ponds would not have broken had defendant opened the flood gates sooner, as plaintiff had requested. Defendant contended that the flood was unprecedented, and that he was not required to guard against such unusual occurrances. Affirming a judgment for defendant, the court held that those who obstructed the flow of a stream were not required to guard against unusual and extradordinary floods which could not be reasonably anticipated. As to plaintiff's request to open the flood gates sooner, the court noted that defendant owed duties to upper as well as to lower riparian owners to maintain the flow of the river so as to do no damage to either upper or lower riparian owners. (Liptak-Fla)
W70-09089

WATER LAWS AND CONCEPTS,
Geological Survey, Washington, D.C.
Harold E. Thomas.
Available free on application to the US Geological Survey, Wash, DC 20242. US Geological Survey Circular 629, 1970. 18 p, 30 ref.

Descriptors: *Water law, *United States, *Water rights, Social aspects, Water utilization, Institutions, Governments, Legislation, Water management (Applied), Legal aspects, Water resources development.
Identifiers: U.S. Water law.

Throughout human history various laws and customs have developed concerning the individual rights and rights in common to the waters of the earth. Some laws and concepts have been carried by people in their migrations and colonial expansions to vastly different environments, with rather curious consequences. Some water laws that had been well adapted to the natural environment have become less tenable because of man's activities in modifying that environment, or because of increasing use of water. The water-rights systems in the United States vary from State to State: some are reasonably fitted to their environment, some have outlived their place in history, some are wasteful of water, some show favoritism to certain special interests or segments of the population. Water-use rights are universally recognized as real property, with constitutional protection against deprivation without due process of law. (Knapp-USGS)
W70-09131

CITY OF NEW YORK V WILSON AND CO (EJECTMENT ACTION BY CITY SEEKING POSSESSION OF FILLED LANDS ORIGINALLY BELOW THE HIGH WATER MARK OF RIVER).

278 N Y 86, 15 NE2d 408-416 (1938).

Descriptors: *New York, *Landfills, *High water mark, *Boundaries (Property), Land tenure, Boundary disputes, Ownership of beds, Maps, Navigable rivers, Land use, Riparian rights, Docks, Judicial decisions, Legal aspects, Cities, Prescriptive rights, Leases, Beds under water, Condemnation, Access routes, Legislation, Appropriation, Local governments, Low water mark.

The City of New York brought an ejectment action against defendant, claiming that the land defendant occupied was below the original high water mark of the East River and that all land between the original high and low water marks of the River had been granted to the city in charters dating back to colonial times. The evidence showed the land involved to have in fact been below the high water mark and to have been created by filling operations. The court held that such land was to be treated as land still under water, even after filling, and that the city still had title unless the defendant could show adverse possession. A statute passed in 1871 had made all lands under water belonging to the city inalienable. After this date, the court held, adverse possession could not run in favor of defendant. As defendant could not show adverse possession prior to 1871, the city still had title to the land and was entitled to ejectment. The defendant was, however, held entitled to access to the river, as this was a riparian right attaching to certain upland held by defendant and which had not been affected by the 1871 statute. (Caldwell-Florida)
W70-09142

MOHAWK CARPET MILLS, INC V NEW YORK (DAMAGES FROM FLOOD AND ICE JAM).
296 NY 609, 68 NE2d 885-886 (1946).

Descriptors: *New York, *Ice, *Ice jams, *Flood damage, Damages, Flooding, Flood protection, Ice breakup, Rivers, Ice loads, Canals, Channels, Bodies of water, Canal construction, Inland waterways, Canal design, Spoil banks, Legislation, Legal aspects, Judicial decisions, Boulders, Obstruction to flow, Alteration of flow, Natural flow doctrine, Explosives.

Plaintiff carpet mill brought action against defendant state seeking to recover for damages caused by a flood and ice jams in the Mohawk River and barge canal. Defendant had converted the river into a barge canal and in so doing had altered the channel by widening it, thereby creating spoil accumulation. An ice jam had backed up to plaintiff's property, and, when the river rose following upstream rain, the ice and flood water came onto the property, crushing a wall of the mill and doing other serious injury. Plaintiff argued that the state should have taken action, such as dynamiting the jam, in order to protect waterfront property. Defendant claimed that such jams had always freed themselves and that no action had appeared necessary to protect the property. In a per curiam decision, the New York Court of Appeals held the state liable for the damage caused by its failure to act. (Barker-Florida)
W70-09157

SLIDE MOUNTAIN REALTY CO V STATE (CONDEMNATION VALUE OF A WATER BODY AND DAM).
306 NYS2d 519-528 (Ct Cl 1969).

Descriptors: *New York, *Condemnation, *Condemnation value, *Eminent domain, State governments, Adjudication procedure, Easements, Judicial decisions, Land tenure, Legal aspects, Ownership of beds, Proprietary power, Relative rights, Right of way, Remedies, Dams, Ponds, Spillways, Replacement costs, Estimating.

The dispute in this case arose from a condemnation proceeding concerning an award for the replacement cost of a dam, pond and spillway located on the condemned property. The appraiser for defendant state testified that he included the amount by which the pond, dam and spillway enhanced the value of plaintiff's property in his estimate of the fair market value before condemnation. Although plaintiff's appraiser did not value the pond, dam and spillway as an independent improvement, nevertheless he included as an item for damages $49,500 over and above the value of the land alone, as a replacement cost for the pond, dam and spillway. The court found from the evidence that the estimate of defendant's appraiser was fair, and that the pond, dam and spillway did not contribute enhancement value sufficiently to warrant a separate award for the cost of their replacement. (Clarke-Florida)
W70-09158

ANDERSON V HOBBS TIE AND TIMBER C (TITLE TO BRIDGE RESTING UPON RIVE BED).
120 SW2d 158-160 (Ark 1938).

Descriptors: *Arkansas, *Ownership of bed *Bridges, *Right-of-way, Structures, Railroad Beds, Beds under water, River beds, Judicial dec sions, Legal aspects, Riparian rights, Relati rights, Rivers, Remedies, Easements.
Identifiers: Injunctions (Prohibitory).

In a suit to enjoin the removal of a railroad brid located in a river by the grantee of land adjacent the bridge, plaintiff asserted title to such bridge virtue of a right-of-way acquired by his predecess in title. Defendant corporation intervened, a claimed title by virtue of a deed of conveyance another tract of land adjacent to the bridge. T court found that the ends of the bridge had co lapsed into the water and rested upon the bed the river. The court held that defendant had n been conveyed the bed of the river so as preclude any claim it had to the title of the brid Plaintiff's title, received from the owner of an eas ment for the railroad right of way on which th bridge was located was held to be superior. Co sequently, since title to the bridge was in plaintif an injunction prohibiting its removal was grante (Snow-Florida)
W70-09159

W A ROSS CONST CO V YEARSLE (GOVERNMENTAL LIABILITY FO DAMAGES ARISING FROM IMPROVEMEN OF NAVIGATION).

103 F2d 589-593 (8th Cir 1939).

Descriptors: *Dikes, *Alteration of flow, *Erosio *Navigation, River training, Navigable river Riparian rights, Banks, Diversion, Judicial dec sions, Relative rights, Riparian land, Damages, Ac celerated erosion, Barriers, Rivers, River flow, Mi souri River, Federal government, Eminent domai Legal aspects, Compensation, Construction.

In an action for damages, plaintiffs contended tha defendant construction company had constructe dikes in the Missouri River which deflected the cu rent of the River causing plaintiffs' lands to b washed away. Defendant, agent of the Unite States under a contract to construct such dikes fo the purpose of improving navigation, contende that the injury was not of a character which entitle the plaintiffs to compensation. Defendant argue that it had constructed such dikes pursuant t directions and supervision of the federal gover ment. The court held that the United States, an thus its agent who had not exceeded the scope of it validly conferred authority, was not responsible t riparian owners for consequential damages fro structures lawfully constructed in aid of navigatio Such consequential damages are not such a takin of property within the meaning of the fifth amend ment as to require compensation. The riparia owner on navigable waters must bear the con sequences of an improvement of navigation by th United States in the exercise of its dominant righ in that regard. (Snow-Florida)
W70-09163

DANFORTH V UNITED STATES (CONDEMNA TION VALUE OF EASEMENT FOR FLOO CONTROL PURPOSES).
102 F2d 5-10 (8th Cir 1939).

Descriptors: *Condemnation, *Condemnatio value, *Easements, *Federal jurisdiction, Floo control, Eminent domain, Legal aspects, Compen sation, Judicial decisions, Mississippi River, Rivers Federal government, United States, Riparian land Contracts, Claims (Contract), Jurisdiction.

Pursuant to federal statute, defendant entered int a contract with the United States for an easemen of flowage rights, for flood control purposes, ove

defendant's lands. The United States repudiated the contract and brought a condemnation proceeding to obtain the easement. Defendant landowner contended that he was entitled to have his damages determined under the prior agreement. The United States contended that a federal court was limited in jurisdiction so as to be able to hear only the condemnation question and could not entertain a claim on the breach of contract. The court held that the doctrine of sovereign immunity precluded it from considering the contract claim. Thus, its only recourse was a consideration of the condemnation suit, and its determination of value of damages was to be made pursuant only to the statute authorizing such condemnation. (Snow-Florida)
W70-09164

UNITED STATES V MCINTIRE (OWNERSHIP OF WATER RIGHTS ON INDIAN RESERVATION).
101 F2d 650-654 (9th Cir 1939).

Descriptors: *United States, *Indian reservations, *Water utilization, *Irrigation programs, Relative rights, Water users, Water rights, Federal reservations, Public land, Legislation, Irrigation water, Beneficial use, Irrigation practices, Irrigation, Irrigation ditches, Irrigation systems, Appropriation, Prior appropriation, Priorities, Judicial decisions, Remedies, Legal aspects, Canals.

Plaintiff Indians brought suit to prohibit the acquisitions of certain water rights by defendant United States for use in an irrigation project. Plaintiffs claimed the rights through prior appropriation by their ancestor who had built an irrigation ditch on land which was part of the Indian reservation. Plaintiffs argued that such appropriation precluded interference with their right to exclusive use of the water. Defendant, who sought to construct a more complex irrigation system in the area, claimed that plaintiffs had not acquired any valid rights through their use of the water. The United States argued that the water rights in question had been reserved from the public land and that they could be transferred to a private company for the purpose of an irrigation project. The Circuit Court of Appeals, Ninth Circuit, ruled that the water rights had been reserved by federal statute and that the law protecting the use of water on public lands was not applicable. Therefore, the government could transfer the rights to the irrigation company since plaintiffs' ancestor had not acquired any exclusive rights to the water use. (Barker-Fla)
W70-09169

UNITED STATES V WALKER RIVER IRRIGATION DIST (RIGHT TO USE OF STREAM BASED ON PRIOR APPROPRIATION).
104 F2d 334-340 (9th Cir 1939).

Descriptors: *Prior appropriation, *Irrigation water, *Indian reservations, *Appropriation, Diversion, Natural flow, Water rights, Preferences (Water rights), Priorities, Riparian rights, Competing uses, Irrigation, Judicial decisions, Relative rights, Non-navigable waters, Streamflow, Streams, Federal jurisdiction, Irrigated land, Legal aspects, Flow federal reservations, Reservation doctrine.

The United States brought a suit to adjudicate relative rights in a non-navigable stream running through an Indian reservation and to restrain defendant appropriators of the waters from interfering with the natural flow of the stream. The United States, acting on behalf of the Indians on the reservation, contended that the waters of the stream had been reserved to the extent necessary to supply the reservation with irrigation water when the reservation was created. Defendants, upstream riparian landowners and appropriators of the waters, contended that they had a paramount claim to rights in the stream by virtue of the fact that they were the first to actually divert and use the stream, even though the reservation had been established a year earlier. The appellate court held that there was an implied reservation of the flow of the stream for Indian use when the reservation was created and that such reservation of the stream by the federal government exempted the waters from subsequent appropriation. Thus defendants were enjoined from interfering with the natural flow of the stream. (Snow-Fla)
W70-09174

BLASK V SOWL (OWNERSHIP OF ISLANDS IN NAVIGABLE WATERS).
309 F Supp 909-914 (W D Wisc 1967).

Descriptors: *Wisconsin, *Islands, *Boundary disputes, *Ownership of beds, River beds, Navigable rivers, Boundaries (Property), River flow, Accretion (Legal aspects), Reliction, Deposition (Sediments), Shores, Patents, Competition, Federal government, Water law, Riparian rights, State jurisdictions, Legal aspects, Judicial decisions, Mississippi River.
Identifiers: *Island ownership.

Plaintiff successor in interest to patentee of shorelands brought an ejectment action against the Bureau of Sport Fisheries and Wildlife of the United States Department of Interior to obtain possession of a portion of an island in the Mississippi River. Under Wisconsin law, the owner of shorelands owns all land between the shore and the thread of a river. Plaintiff, who reserved all rights to the island between the shoreland he had deeded away and the thread of the river, relied on this law in his claim to the island. The district court held that state law regarding riparian rights on navigable waters does not apply to property owned by the United States. As regards navigable waters, the rights of the state reach to the waters and soil there-under, not to islands which rise above the surface of the water. United States patents can, with the assistance of state law, convey title to river-beds, but title to islands in navigable waters remains in the United States. Therefore plaintiff did not have title to the island since such title had never been taken out of the United States. (Price-Fla)
W70-09175

UNITED STATES V ALASKA (RELATIVE RIGHTS IN SUBMERGED LAND).

423 F2d 764-768 (9th Cir 1970).

Descriptors: *Alaska, *Beds under water, *Ownership of beds, *Federal government, Lake beds, Federal-state water rights conflicts, Federal reservations, Withdrawn lands, Federal jurisdiction, State jurisdiction, Leases, Oil industry, Natural gas, Submerged Lands Act, Legislation, Wildlife conservation, Public lands, Wildlife habitats, Judicial decisions, Legal aspects.

The United States brought action to quiet title to lands under a lake in a certain Alaskan mountain range. In 1941 a presidential order made the range a wildlife refuge. In 1958 the Secretary of the Interior closed the southern half of the range to gas and oil leasing. However, in 1966 Alaska issued oil and gas leases to portions of the land beneath the lake. Defendant state and its lessees contended that under the general land laws of the United States, public lands did not include land under water. Defendants also claimed title to the land under water by application of the Submerged Lands Act. The court rejected defendants' contentions and held that the presidential order withdrawing and reserving for the Department of the Interior the disputed area of land and water was intended to include land under water, and thus the land did not pass to the state of Alaska on its admission to the Union. The general land laws of the United States and the Submerged Lands Act had no application to the disputed lands. The lands were set aside for a valid public purpose and the executive order could not be affected by Alaskan game laws. (Hubener-Florida)
W70-09242

DAVIS V CITIES SERVICE OIL CO (LIABILITY FOR DAMAGES CAUSED BY OIL POLLUTION).
420 F2d 1278-1282 (10th Cir 1970).

Descriptors: *Oil, *Water pollution sources, *Overflow, *Damages, Pollutants, Water pollution, Path of pollutants, Soil contamination, Oil industry, Oil wastes, Oily water, Weirs, Rivers, Streams, Legal aspects, Remedies, Judicial decisions, Kansas.

Plaintiff land owners and tenants brought action against various oil companies for damages allegedly caused by oil pollution. Defendants operated drilling fields and refineries along waterways that ran past plaintiffs' properties. It was contended that overflow from retention basins and seepage had entered the streams and damaged plaintiffs' property when the river overflowed its banks following rain storms. Defendants contended that the oil in question did not come from their operations, and they alleged that the source of the oil was not under their control. The trial court determined that plaintiffs' evidence was insufficient to prove liability on the part of defendants. The Court of Appeals for the Tenth Circuit ruled that such questions of fact were not reviewable and affirmed the judgment for defendants. (Barker-Florida)
W70-09243

BURAS V ELLZEY (POSSESSORY RIGHTS IN WATERFRONT PROPERTY).
233 So 2d 586-589 (La Ct App 1970).

Descriptors: *Louisiana, *Land tenure, *Real property, *Boundaries (Property), Relative rights, Navigable waters, Riparian rights, Mississippi River, Surveys, Inspection, Legal aspects, Judicial decisions, Channel morphology, Beds, Ownership of beds, Beds under water, Meanders, Geomorphology, Boundary disputes.

Plaintiffs, record title holders to certain waterfront logs, brought action against defendants for alleged possession of the lots in 'bad faith.' Plaintiffs contended that the property was above water and that defendants were wrongfully in possession. Defendants alleged that plaintiffs' lots were now under water as a result of the shifting of the river, and that they therefore could not be in possession. Conflicting expert testimony of two surveyors was introduced. The trial court then ruled that plaintiffs' lots had become part of a navigable stream, and were, in fact, under water. On appeal, the court ruled that the trial court's acceptance of one survey was not clearly erroneous, and the judgement on behalf of defendants was affirmed. (Barker-Florida)
W70-09323

BLISS V KINSEY (EXTENSION OF BOUNDARY LINES FROM MEANDER LINE TO SHORE LINE).
233 So 2d 191-194 (2d D.C.A. Fla 1970).

Descriptors: *Florida, *Boundary disputes, *Riparian lands, *Shores, Riparian rights, Boundaries (Property), Relative rights, Water rights, Equitable apportionment, Meanders, Shores, Accretion (Legal aspects), Judicial decisions, Legal aspects, Real property, Gulf of Mexico, Adjudication procedure.
Identifiers: *Meander lines.

Plaintiff and defendant were adjoining land owners. The title description fixed the boundary of both lots on a meander line of the Gulf of Mexico. There was a strip of land between the meander line and the shore line to which the government had not retained title. The question was how to extend the boundary between the lots to the shore line. The lower court held that the boundary would be drawn and the land apportioned in the manner it would have been if the land between the meander line and the shore line had been created by accretion. The line was extended so as to provide each lot with the

same relative amount of shore line as it had on the meander line in the original survey. In affirming, the court recognized that although meander lines are not treated as boundaries, courts should at least approximate the amount of shore line as indicated on a meander line when called upon to establish actual boundaries. Where riparian rights are to be extended to the shore, all of the circumstances of the case should be considered. (Price-Florida)
W70-09343

BRANT LAKE SHORES, INC V BARTON (ADVERSE POSSESSION OF LAND BELOW THE HIGH WATER MARK).

307 NYS2d 1005-1014 (Sup Ct 1970).

Descriptors: *New York, *Boundary disputes, *Ownership of beds, *Lake shores, Boundaries (Property), Easements, Leases, Legal aspects, Recreation, Relative rights, Riparian land, Riparian rights, Riparian water, Usufructuary right, Water rights, High water mark, Water level fluctuations, Watercourses (Legal), Low water mark, Beaches, Boating, Camping, Lakes, Lake beds, Recreational facilities, Judicial decisions, Prescriptive rights.

Plaintiff owned land adjacent to a lake, and claimed that, according to his deed, the boundaries of the property ran to the center of the lake. Defendant claimed that plaintiff owned only to the high water mark. An early deed in plaintiff's chain of title had set the lakeside boundary of plaintiff's lot at the high water mark. The next deed in the chain of title, however, and all deeds succeeding it, including plaintiff's, described the lakeside boundary of the lot as the low water mark. Plaintiff and his predecessors in title had openly and continuously used the beach and the waters of the lake, for commercial purposes in the form of boat rentals and camper's privileges, for over 40 years. The court held that a deed in a chain of title setting the boundary of lakeside property at the high water mark clouds any title claimed by the owner to the center of the lake. Only a boundary description set at the low water mark passes title to the center of the lake. In this case, however, plaintiff's use and possession of the waters of the lake and the beaches, unrebutted by the owners of the lake rights, constituted acquisition of title, by adverse possession, to the center of the lake. (Clarke-Florida)
W70-09355

CHAPTER 2: INSTITUTE FOR ANALYTICAL STUDIES.
National Academy of Sciences-National Academy of Engineering, Washington, D.C. Environmental Studies Board.

In: Institutions for Effective Management of the Environment, Washington, D.C. National Academy of Sciences - National Academy of Engineering, January 1970, p 17-28.

Descriptors: *Enviroment, *Management, *Planning, Institutions, Administration.
Identifiers: *Public policy, Early-warning capability, Interdisciplinary studies, Institute for Analytical Studies.

Of several institutions believed necessary to cope with the environment, one of the most important would be designed to: (1) Do the long-range planning necessary for restoring and protecting the quality of the environment; (2) Provide early warning of potential threats to the environment; (3) Conduct rapid analytic studies in response to emergencies, and; (4) Produce rapid field analysis. A number of considerations are suggested as necessary for a viable and effective institute for analytical studies: (1) Independence from the influence of any government agency or special interest; (2) Public availability of all studies, (3)Confidence of clients and the public in the integrity and independence of the institute, (4) Comprehensive representation of relevant disciplines, (5) A highly talented and dedicated professional staff, (6) A group of experienced public-policy specialists and, on an ad hoc basis, consultation with administrators and elected officials; and (7) A policy of recruiting young people for positions of responsibility and influence. (See also W70-08929) (Davis-Chicago)
W70-09440

CHAPTER 5: NATIONAL LABORATORY FOR ENVIRONMENTAL SCIENCE.
National Academy of Sciences-National Academy of Engineering, Washington, D.C. Environmental Studies Board.

Washington, D.C., National Academy of Sciences - National Academy of Engineering, January 1970. p 43-48.

Descriptors: *Environment, *Research and Development, *Research facilities, Forecasting, Management, Institutions.
Identifiers: *National Laboratory for Environmental Science, Environmental crisis, Quick-reaction field studies.

It is recommended that a National Laboratory for Environmental Science be established. This National Laboratory for Environmental Science should be responsible for basic and applied research with the following objectives: (1) Analysis of the interaction of environmental factors, leading to; (2) Development of the capacity to predict environmental changes, and thus; (3) Development of the capability to maintain, modify, restore, improve, and generally manage the environment. An additional function of the laboratory will be to have the capability to carry out quick-reaction field studies pertinent to an environmental crisis. (See also W70-08929) (Davis-Chicago)
W70-09443

CHAPTER 6: FEDERAL ORGANIZATION FOR MANAGING THE ENVIRONMENT.
National Academy of Sciences-National Academy of Engineering, Washington, D.C. Environmental Studies Board.

Washington, D.C., National Academy of Sciences - National Academy of Engineering, January 1970, p 49-57.

Descriptors: *Environment, *Management, *Institutions, Inter-agency cooperation, Institutional constraints, Planning, Administration, Legislation.
Identifiers: *Board of environmental affairs, Environmental quality council, Policy.

It is felt that the Environmental Quality Council, a group of highest-level government officials supported by a part-time staff is an inadequate response to the problem of developing mechanisms for effective environmental management. The problem of reorganization of executive and congressional activities into a more closely coordinated effort are reviewed. It is recommended that reorganization should come about only after sophisticated management analysis, coupled with a realistic assessment of Executive-Congressional relationships. It is recommended that a Board of Environmental Affairs within the Office of the President be established. This Board should recommend and assist the President in formulating policies; evaluate programs and activities of departments and agencies and consider how they will affect the environment; analyze, interpret, and provide assistance in generating needed data concerning environmental matters; serve as a coordinator on a working level for interdepartmental activities relating to the environment; and assist state and local governments in dealing with environmental problems. Differences between the Board and the existing Environmental Quality Council are summarized. (See also W70-08929) (Davis-Chicago)
W70-09444

IN RE CITY OF NEW YORK (RIGHTS O OWNERS OF BEDS SUBSERVIENT T UPLAND OWNER'S RIPARIAN RIGHTS).

158 Misc 684, 286 NYS 131-136 (Sup Ct 1936).

Descriptors: *New York, *Riparian rights, *Be under water, *Easements, Cities, Damage Remedies, Condemnation, Compensatio Eminent domain, Underwater, Land, Judicial dec sions, Riparian waters, Riparian land, Reasonab use, Competing uses, Relative rights, Island Ownership of beds, Usufructuary right, Lar tenure.

Defendant city brought condemnation proceedin to acquire plaintiff's underwater lands, whic abutted on an island owned by defendant. The underwater lots had been partitioned by cou decree and were distributed to plaintiff's predece sors in title. Plaintiff, therefore, contended that h underwater lands were not subject to the ripari rights of defendant upland owner. Moreover, plai tiff maintained that where underwater lands mig ordinarily be subject to an easement of the abuttin upland owner, there was no easement in this situ tion by reason of the court decree of partitio which destroyed any easement or rights of defe dant to these underwater lots. Defendant claime that the law of the state was that an upland own may not be prevented from exercising his ripari rights to the waters, and lands under such wate adjacent to such upland. The court held that plai tiff's underwater lands, no matter how partitione were subject to defendant's riparian rights an easement. However, the court also noted that th existence of such easement did not deprive plainti of the right to damages which resulted from defe dant's interference with the reasonable use b plaintiff of his lands. (Finman-Florida)
W70-09457

UNITED STATES EX REL TVA V POWELSO (CONDEMNATION VALUATION).
319 US 266, 63 S Ct 1047-1061 (1943).

Descriptors: *United States, *Tennessee Valle Authority Project, *Condemnation valu *Eminent domain, Hydroelectric plants, Dam Streams, Legislation, Condemnation, Judicial dec sions, Legal aspects, Damages, Non-navigabl waters, Land use, Market value, North Carolin Relative rights, Compensation, Hydroelectri power, Evaluation, Land tenure, Land develop ment, Administrative agencies, Public utilities.

Plaintiff private power company, which had bee granted the power of eminent domain by Nort Carolina, had its land condemned for a TVA pro ject. Plaintiff sought to place a very high value o the property, arguing that it could be combine with adjoining property condemnable by the com pany to form a large hydroelectric project. Th court rejected this contention because the con demnee's eminent domain power had not been ex ercised and was revocable by the state at any time The chance of the condemnee being able to com bine the necessary land to construct the hydroelec tric project was considered too remote to affect th valuation of the land. The court held that th United States, in the absence of a specific statutor requirement, was not required to make compensa tion for the loss of a business opportunity based o the unexercised privilege to use the power o eminent domain. (Caldwell-Florida)
W70-09459

COLORADO V KANSAS (APPORTIONMEN OF WATER BETWEEN UPRIVER AN DOWNRIVER STATES).
320 US 383, 65 S Ct 176-184 (1943).

Descriptors: *Kansas, *Colorado, *Interstat rivers, *Equitable apportionment, Natural flo doctrine, Riparian rights, Water utilization, Com peting uses, Relative rights, Diversion, Reasonabl use, Legal aspects, Judicial decisions, Water right

/ater allocation (Policy), Water contracts, Irriga-
on, Beneficial uses, Water demand, Gradually
ried flow, Irrigation water, Flow measurement.

ansas had for some time claimed that Colorado
d appropriated so much water from the Arkansas
iver for irrigation in Colorado that severe injury
as caused to downstream Kansas property. In an
rlier action between the same parties, the
preme Court had denied Kansas' contention that
was entitled to have the river flow as it did in its
tural state. In that case, it was held that Colorado
as not unreasonably diverting water from the
ver, and that any injury to Kansas property must
e weighed against the benefits of irrigation to the
ea as a whole. In the instant case, Kansas argued
at the use of the water in Colorado had increased
such an extent that the diversion unreasonably
jured Kansas riparian land. The Court rejected
is contention, reaffirming its holding in the earli-
case, finding insufficient evidence of any drastic
crease in Colorado water utilization. A recom-
ended ruling by a special master, which would
ve awarded five-sixths of the water by acre-feet
Colorado and one-sixth to Kansas, was rejected.
e Court held that the balance of interests had
en struck in favor of Colorado in the previous
se, and no reason for overturning that ruling had
en presented. (Caldwell-Florida)
70-09460

EBRASKA V WYOMING (APPORTIONMENT F INTERSTATE WATERS UNDER PRIOR AP-ROPRIATION).
25 US 589, 65 S Ct 1332-1373 (1945).

escriptors: *Equitable apportionment, *Interstate
mpacts, *Prior appropriation, *Natural flow
octrine, Wyoming, Nebraska, Colorado, United
ates, Water allocation (Policy), Federal govern-
ent, Legal aspects, Legislation, Federal-state
ater rights conflicts, Relative rights, State govern-
ents, Unappropriated water, Water demand,
/ater supply, Water resources development, Inter-
asin transfers, Irrigation, Return flow, Reservoirs,
rought, Water storage.
entifiers: *Apportionment.

he North Platte River, a non-navigable stream,
iginated in Colorado, flowed through Wyoming
d Nebraska and emptied into the Missouri River
ear the Iowa border. A controversy arose con-
rning the use of the waters of the river for irriga-
on purposes. Nebraska claimed that the other two
ates were violating the rule of priority of ap-
opriation in force in all three states, thereby
priving Nebraska of water to which it was
quitably entitled. The Supreme Court adopted
bstantially the findings of the special master. The
neral holdings of the Court were: (1) the Desert
and Act made a non-navigable water supply on
ublic land free for private appropriation and
parate from the land itself; (2) where several
ates recognizing the rule of prior appropriation
e served by an interstate river, the rule of prior
propriation primarily will govern their relative
ghts as to the allocation of the water of the river,
d such allocation must be based on the dependa-
e flow, not the long-time average flow of the
ver; and (3) in such a situation, the court will al-
cate only the natural flow, not storage water,
hich is defined as water released from reservoirs;
ch storage water, however, may be considered in
quitably apportioning the natural flow among the
ates involved. (Clarke-Florida)
70-09461

EARD'S ERIE BASIN V NEW YORK (RIGHTS O COMPENSATION AWARD BASED ON WNERSHIP OF LANDS CONDEMNED).

42 F2d 487-491 (2d Cir 1944).

escriptors: *New York, *Condemnation, *Com-
ensation, *Ownership of beds, Navigable waters,
minent domain, Patents, Legislation, Grants,
tate governments, Riparian waters, Judicial deci-
sions, Legal aspects, Riparian land, Land tenure, Land use, Federal government, Landfills, Land forming, Relative rights.

The United States condemned certain land, part of which was under navigable waters. A dispute arose between plaintiff and defendant state as to their respective rights in the resulting condemnation award. Plaintiff contended it owned in fee all the land condemned by virtue of letters patent and legislative grants. Defendant contended that said documents were invalid, or in the alternative, if valid, that a possibility of reverter remained in the state so as to entitle it to a share of the award. The court held that plaintiff's grants and patents were valid, that under New York law the state was empowered to alienate lands under navigable waters to private parties and that once the conditions in the grants were met by the grantee the possibility of reverter in the state disappeared. Plaintiff was held to be the owner in fee simple of all the condemned land, and to be entitled to the full condemnation award. (Price-Florida)
W70-09463

LONDON EXTENSION MINING CO V ELLIS (OWNERSHIP OF ACCRETED LANDS).
134 F2d 405-412 (10th Cir 1943).

Descriptors: *Colorado, *Accretion (Legal aspects), *Mine wastes, *Waste dumps, Legal aspects, Judicial decisions, Mining, Seepage, Riparian rights, Land forming, Land tenure, Real property.

In a case involving a contest over mining rights and ownership rights to a dump created by mining wastes and low grade ore, the court stated that when tailings are permitted to pass by stream or seepage onto another tract, they become an accretion to such tract and belong to the owner thereof. (Price-Florida)
W70-09465

UNITED STATES V OTLEY (OWNERSHIP OF LAKE BEDS).
127 F2d 988-1001 (9th Cir 1942).

Descriptors: *United States, *Boundary disputes, *Ownership of beds, *Meanders, Reservation doctrine, Oregon, Boundaries (Property), Federal government, Judicial decisions, Legal aspects, Land tenure, Proprietary power, Relative rights, Riparian land, Riparian rights, Watercourses (Legal), Lakes, Lake beds, Lake shores, Surveys, Real property.

By executive order, a non-navigable lake in Oregon was officially reserved as a federal sanctuary for migratory birds. Subsequent thereto the lake was surveyed and meandered by the General Land Office. Plaintiff United States then patented to defendants the fractional lots surrounding the lake. The official plat of said lands, as determined by the survey, was incorporated in the patents. Plaintiff sued to quiet title to the lake bed, contending that the meander line represented merely the boundary of defendants' upland, not the true shoreline of the lake, since the high water mark of the lake fluctuated so greatly. Defendants claimed title to the center of the lake as riparian landowners bordering a nonnavigable waterbody. The court held that where the amount of land between the surveyed meander line and the actual shore of the lake greatly exceeds the total area described in a patent to said land, the meander will not be considered that of the lake but a mere irregular boundary of the upland. A patent to such land would not transfer any title to land under the lake. In such a case, however, the heavy burden of proof is on the plaintiff to show that the meander line is not the approximate boundary of the lake, and here the United States failed to sustain that burden. (Clarke-Florida)
W70-09467

CARTER OIL CO V DELWORTH (LESSEE OF LAND ABUTTING CREEK HAS RIGHT TO CREEK BED).
120 F2d 589-591 (7th Cir 1941).

Descriptors: *Illinois, *Streambeds, *Leases, *Drilling, Streams, Grants, Oil industry, Legal aspects, Judicial decisions, Real property, Land, Natural resources, Oil fields, Boundaries (Property), Rivers, Ownership of beds, State governments, State jurisdiction, Federal jurisdiction, Beds, River beds, Remedies, Relative rights.
Identifiers: *Exclusive rights.

Plaintiff oil company's lessor was conveyed land abutting a creek. Subsequently, the same grantor leased the adjoining creek bed to defendants' assignor. These lands were acquired by plaintiff and defendants for the purpose of drilling for oil. Plaintiff brought suit to enjoin defendants' drilling in the creek bed, claiming the lease to the land abutting the creek entitled him to the exclusive right to drill the creek bed. Defendant contended that plaintiff's lease to the land bordering the creek did not include any rights to the creek bed. The court stated that, under state law, a grant of land bordering a creek or river gives the exclusive right and title to the center of the stream to the grantee, unless the grantor intended to reserve rights to the creek bed. The court did not read into plaintiff's lessor's deed any intended reservation of title to the creek bed, nor did the court find a reservation implied by the actions of the grantor. Therefore, in holding for plaintiff, the court recognized the rule that where there is no evidence of a contrary intent, the title to land bordering a stream extends to the center of such stream. (Finman-Florida)
W70-09468

BERGER V OHLSON (NO ABSOLUTE RIGHT TO TOLL FREE USE OF GOVERNMENT CONTROLLED DOCK).

120 F2d 56-60 (9th Cir 1941).

Descriptors: *Alaska, *Docks, *Payment, *Cities, Ships, Harbors, Railroads, Federal government, Federal jurisdiction, Public benefits, Construction, Judicial decisions, Legal aspects, Permits, Control, Royalties, Regulation, Standards, Land tenure, Relative rights, Use rates.
Identifiers: Tideland.

Plaintiff shipping company unloaded its large cargo ships by use of lighters or barges, which, in turn, carried the cargo to a city dock. Defendant railroad, which was owned and operated by the federal government, objected to plaintiff's lightering its cargo to the city dock since plaintiff was able to avoid wharfage fees exacted for the use of defendant's dock. Therefore, in an effort to overcome plaintiff's competition, defendant demanded the payment of wharfage fees for plaintiff's use of the city dock. Plaintiff sought to enjoin defendant's demand of wharfage fees and interference with his use of the city dock. Plaintiff contended that the city owned the dock and that he was therefore privileged to use such dock as a member of the public without the payment of wharfage fees. Defendant maintained that even though the city had built the dock, it was constructed on upland and tideland owned by the federal government, and was therefore subject to defendant's control. The court held that plaintiff had a mere license to the use of the city dock, and that defendant exercised its lawful authority by exacting a wharfage fee. (Finman-Florida)
W70-09469

BROOKS V UNITED STATES (JURISDICTION OF FEDERAL COURT TO DETERMINE WATER RIGHTS IN INTERSTATE RIVER).

119 F2d 636-647 (9th Cir 1941).

Descriptors: *Federal jurisdiction, *Jurisdiction, *Interstate rivers, *Water users, Operating costs,

Federal governments, United States, Arizona, New Mexico, Water supply, Water rights, Water management (Applied), Water distribution (Applied), Rivers, Water delivery, Water costs, Water control, Water allocation (Policy), Upstream, Remedies, Distribution systems, Legal aspects, Judicial decisions, Appropriation, River flow.
Identifiers: *Contempt (Legal aspects).

Defendant upper water users, residents of New Mexico, were parties to proceedings brought by the United States in the federal district court of Arizona, which determined the rights of all water users to the waters of an interstate river which originated in New Mexico and flowed through Arizona. Defendants subsequently appropriated more water from the river than they were entitled to under the terms of the court's decree. In addition, defendants failed to pay their fair share of the operating costs of the distribution system set up by such decree. Therefore, plaintiff brought contempt proceedings against defendants for committing such acts in violation of the court decree. Defendants contended the court in Arizona did not have jurisdiction to determine the rights of water users in New Mexico, as a suit to adjudicate water rights was a local action. The court held defendants guilty of contempt, and stated that the Arizona court had jurisdiction to determine the rights of the upper water users in New Mexico to the interstate river insofar as such determination was directly related to the rights of the water users in Arizona. (Finman-Florida)
W70-09470

ALBION-IDAHO LAND CO V NAF IRRIGATION CO (PRORATION OF WATER RIGHTS UNDER PRIOR APPROPRIATION DOCTRINE).

97 F2d 439-445 (10th Cir 1938).

Descriptors: *Prior appropriation, *Priorities, *Proration, *Preferences (Water rights), Adjudication procedure, Judicial decisions, Jurisdiction, Federal jurisdiction, State jurisdiction, Streamflow, Streams, Non-navigable waters, Water rights, Appropriation, Beneficial use, Diversion, Legal aspects, Water law, Reasonable use, Remedies, Water allocation (Policy), Water loss, Intermittent streams.
Identifiers: Injunction (Prohibitory).

Plaintiff lower landowners in Idaho sought an injunction restraining defendant upstream landowners in Utah from diverting water from an interstate non-navigable stream. On appeal from a judgment for defendants, plaintiffs, relying on prior decrees adjudicating their water rights, contended that the trial court had failed to apply the prior appropriation doctrine and had substituted a fair distribution of the water instead. Defendants asserted their own priorities in the beneficial use of the water and argued that a strict application of the prior appropriation rule resulted in waste when the streamflow was so diminished that the water would not reach the downstream prior appropriator in useful quantities. The court noted that prior appropriation applies to interstate streams where, as here, both states recognize the rule. As to the prior decrees, the court held that local actions to adjudicate water rights do not bind strangers to the judgment and do not determine water rights in another jurisdiction. The court then held that when, due to seepage, evaporation and other physical conditions, the water did not reach the prior appropriator in useful quantities, the junior appropriator was entitled to divert the water, thereby recognizing the priorities of the users, avoiding waste and making the best utilization of the water. (Liptak-Florida)
W70-09474

HOLYOKE WATER POWER CO V AM WRITING PAPER CO (USE OF WATER POWER BEYOND SCOPE OF GRANT).

94 F2d 933-934 (1st Cir 1938).

Descriptors: *Massachusetts, *Electric power, *Water supply, *Water utilization, Water users, Mills, Grants, Electric power production, Electric generators, Water wheels, Non-consumptive use, Reasonable use, Transmission (Electrical), Industrial water, Industrial plants, Judicial decisions, Legal aspects.
Identifiers: *Mill power.

Plaintiff water power company brought action to prevent defendant paper company's transfer of electric power from its mill sites to other locations. Defendant, as owner or lessee of certain mill sites whose water was supplied by plaintiff, had constructed electric generators on the sites which were powered by water wheels. The electric power created was transferred to other sites owned by defendant. Plaintiff argued that the original grant of the water supply restricted the use of the mill power to the specific site, and that defendant's operations were in violation of the grant. The First Circuit Court of Appeals ruled that the mill power was in fact being used on the specific sites, and that defendant's conversion of the mill power to electric current was not an improper use of the mill power within the meaning of the grant. The suit was dismissed. (Barker-Florida)
W70-09475

CONTINENTAL LAND CO V UNITED STATES (CONDEMNATION VALUE OF LANDS TO BE FLOODED BY A DAM).

88 F2d 104-111 (9th Cir 1937).

Descriptors: *Damsites, *Dams, *Backwater, *Condemnation value, Sites, Engineering structures, Grand Coulee Dam, Reservoirs, Condemnation, Eminent domain, Legal aspects, Judicial decisions, Federal government, United States, Riparian rights, Rivers, Navigable rivers, Navigation, Rivers and Harbors Act, Legislation, Riparian land, Property values, Compensation.

In proceedings by plaintiff United States to determine compensation for the taking of land bordering a navigable river, defendant riparian landowners contended that they were entitled to an additional compensation for their land which was to be flooded by the backwaters of a dam to be constructed by plaintiff. Defendants' claim for additional compensation was based upon their contention that the land area involved was the only suitable location for the dam. Consequently, they argued that the inherent adaptability of the uplands up a special use in the development of electrical power increased its value over the reasonable market value. The government contended that defendants' compensation was limited to the reasonable market value of the property taken. The court held that the government's absolute power to improve navigation by building the dam precluded private landowners from having any property right in the special use of the navigable waters or power inherent therein. Thus defendants were limited to the reasonable market value of the lands taken. (Snow-Florida)
W70-09477

MIAMI BEACH JOCKEY CLUB, INC V DERN (GOVERNMENT CONTROL OVER OBSTRUCTIONS TO NAVIGATION).
86 F2d 135-136 (DC Cir 1936).

Descriptors: *Navigation, *Navigable waters, *Permits, *Administrative agencies, Relative rights, Judicial decisions, Legislation, Federal government, Landfills, Land forming, Eminent domain, Condemnation, Beds, Compensation, Administrative decisions, Regulation, Legal aspects, Supervisory control (Power), Beds under water.
Identifiers: Obstruction to navigation.

Plaintiff jockey club, having been previously granted a permit by defendant Secretary of War authorizing the filling in of submerged lands in navigable waters, brought this action to enjoin defendant from revoking such permit. Plaintiff contended that such revocation would amount to a tak ing of property without compensation and that th congressional act under which defendant was ac ing in revoking the permit, which conferred upo the Secretary of War the power to determi whether or not a proposed structure was an ob struction to navigation, was an unconstitution delegation of legislative power. In a per curia decision, the court rejected both contentions an held that the permit granted to improve the lands question was revocable by defendant without com pensation. Navigable waterways are always subje to the paramount authority of Congress in the co trol of navigation. (Snow-Florida)
W70-09478

ICKES V FOX (PROTECTION OF PRIVATE AP PROPRIATION RIGHTS IN A FEDERA RECLAMATION PROJECT).

85 F2d 294-299 (DC Cir 1936).

Descriptors: *Federal reclamation law, *Ap propriation, *Preferences (Water rights), *Wate allocation (Policy), Federal government, Unite States, Legal aspects, Water law, Beneficial use, I rigation water, Priorities, Judicial decisions, Adju dication procedure, Claims (Contract), Contrac administration, Regulation, Water rights, Wate contracts, Water requiremtns, Water distributio (Applied), Irrigation programs.

Plaintiff landowners brought action to restrain de fendant Secretary of the Interior from divertin water into a reservoir for a federal reclamation pro ject, thereby limiting plaintiff's water rights. Plain tiffs acquired their appropriation rights from th government's predecessor, an irrigation company and contended that the amount of water supplie for beneficial use at that time, and for twenty yea thereafter, was fixed by contract and could not b diminished. Defendant contended that the sui being against the United States, could not be main tained and that defendant had the authority to limi plaintiffs' water rights since the water was necessa ry to maintain the reservoir. After holding that th suit was allowable as against an agent of th government rather than the government itself, th court found that the Federal Reclamation Act an state law both measured appropriation rights by th amount of water necessary to irrigate the land, an not by the mere diversion and storage of the wate Therefore , the court held that the property right in the water were plaintiffs' rather than the federa government's and were appurtenant to plaintiffs land. The court affirmed the order denying defen dant's motion to dismiss. One justice dissented (Liptak-Florida)
W70-09479

KARLSON V UNITED STATES (CONDEMNA TION OF FLOWAGE EASEMENT OVE RIPARIANS'S LANDS).
82 F2d 330-337 (8th Cir 1936).

Descriptors: *Eminent domain, *Water level fluc tuations, *Easements, *Condemnation value, Con demnation, Legal asepcts, High water mark, Low water mark, Variability, Elevation, Lakes, Relative rights, Judicial decisions, Treaties, Federal Govern ment, Dams, Flow control, Flooding, Property values, Compensation, United States, Beneficia use.

In a condemnation proceeding to obtain flowage easements upon lands bordering a lake, which wa to be regulated in such a manner as to intermit tently raise the water level above the natural high water mark so as to flood defendants' riparian lands, defendants contended that the land to be condemned would have no market value as a result of the intermittent flooding, and sought compensa tion in the amount of such lands' full present mar ket value. The federal government contended that it was obtaining only an easement and not a free title to the land, and that the land could be put to beneficial use when not flooded. Consequently,

ompensation at the present full market value was ot required. The court held that where less than a ee interest is taken and where substantial enjoy- ient of the land remains in the owners, compensa- on is not required at a rate as if the whole proper- was taken. Inasmuch as it is a question for the ry to determine the value of the interest actually ken, the jury verdict granting defendants com- ensation at a rate less than the market value of the e simple title was sustained. (Snow-Florida)
70-09481

EHRENS V CITY OF MINNEAPOLIS (PUBLIC URPOSE REQUIREMENT FOR CHANNEL IM- ROVEMENT).
71 NW 814-817 (Minn 1937).

escriptors: *Minnesota, *Rivers, *Dredging, Channel improvement, Riparian land, Riparian aters, Judicial decisions, Legislation, Legal spects, River beds, Mississippi River, Navigable vers, Headwaters, Taxes, Government finance, ublic benefits, Highways, Barriers, Waterfalls, avigation, Harbors.

efendant city of Minneapolis proposed to dredge ie Mississippi River a distance of 550 feet, includ- g 410 feet fronting private riparian land equipped ith docking facilities serving a gas company. laintiff taxpayer sought to enjoin the expenditure city funds on the project on the grounds that the xpenditure was not for a public purpose, as equired by statute. Defendant contended: (1) that was authorized to improve the channel under a ighway improvement statute; and (2) that im- roved docking facilities might lower the cost of as in the area. Since St. Anthony Falls, a barrier to avigation, lay above the frontage to be dredged, ie Supreme Court of Minnesota held that the only enefit derived from the dredging would accrue to ie private gas company. The river was not a ighway, and the court was not precluded by the ighway statute from inquiring into the existence of public behind proposed municipal expenditures. Dye-Florida)
70-09489

LSEN V CITY OF DEARBORN (EVALUATION F PROPERTY PARTIALLY TAKEN FOR UBLIC UTILITY PURPOSES).
90 Mich 651, 288 NW 295-299 (1939).

escriptors: *Michigan, *Condemnation value, Compensation, *Public utilities, Land appraisal, eal property, Value, Property values, Condemna- on, Judicial decisions, Damages, Legal aspects, ocal governments, Public rights, Cities, Sewers, ipelines, Adjudication procedure, Eminent omain, Pricing, Market value, Adjusted prices, conomic impact.
lentifiers: *Water mains.

laintiff landowners brought actions against defen- ant city to recover damages resulting from defen- ant's construction of sewers and water mains cross plaintiffs' property. Plaintiffs had tendered eeds to 18 foot strips of their land to the city to be sed for streets and alleys, but defendant con- ructed the sewers and water mains before acquir- g title to all of the property needed for the lanned streets. Plaintiff contended that the condi- on attached to the deliverty of the deeds, acquisi- on of all the necessary property, was not per- ormed. Therefore, plaintiffs contended that defen- ant had taken their property and was liable for the arket value of the land taken. Defendant con- nded that the preparation of maps did not con- itute a taking of property, and that the measure amage for injury to the land caused by the sewers nd water mains was the depreciation in the value f the land. Reversing a judgment for plaintiffs, the ourt held that, although defendant was without gal title to the property and had imposed an un- wful servitude upon the land, the proper measure f damages was the depreciation in the value of the roperty rather than the land's market value. (Lip- ak-Florida)
70-09491

ERIE LACKAWANNA RY V SILLS (SUNKEN VESSEL OBSTRUCTING DOCKS AS TRESPASS).

307 NYS2d 803-804 (Sup Ct 1970).

Descriptors: *New York, *Navigation, *Harbors, *Remedies, Federal jurisdiction, Navigable waters, Ships, Transportation, Docks, Legislation, Admiralty, Legal aspects, Law of the sea, Judicial decisions, Federal government, Boats, Barriers, Relative rights, Hazards, Jurisdiction, Damages, Piers.
Identifiers: *Wreck Act.

Defendant was the owner of a barge which had sunk in a certain harbor. The barge obstructed access to plaintiff's docks. Plaintiff brought action under the federal Wreck Act charging defendant with an unlawful trespass by having abandoned the sunken barge. Defendant contended the Wreck Act did not apply to him since he had abandoned the barge in the navigable waters of the harbor. The court held that the rights and duties of the parties were governed by federal maritime law and that plaintiff's complaint was sufficient to sustain a cause of action based on the Wreck Act. The Wreck Act, although penal, would support civil actions by private parties against owners of vessels negligently or willfully sunk in navigable waters. It was only necessary that the plaintiff be within the class of persons Congress intended to protect and the harm the type Congress intended to forestall. Both damages and injunctive relief were available under the Act. (Hubener-Florida)
W70-09500

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, COTTONWOOD CREEK, GUTHRIE, OKLAHOMA.
Corps of Engineers, Tulsa, Okla.
For primary bibliographic entry see Field 04A.
W70-09220

FLOOD PLAIN INFORMATION, SANTA CLARA RIVER, VENTURA COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
W70-09221

FLOOD PLAIN INFORMATION, METROPOLITAN ATLANTA GEORGIA, UTOY CREEK, NORTH AND SOUTH UTOY CREEKS.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W70-09222

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER AND FIVEMILE CREEK, ALLEGANY, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
W70-09252

FLOOD PLAIN MANAGEMENT - IOWA'S EXPERIENCE.
Iowa State Univ., Ames. Dept. of Civil Engineering.

Papers presented at Conference on Flood Plain Management, 6th Water Resources Design Conference, Jan 23-25, 1968, Iowa State University; Merwin D. Dougal, editor, published by Iowa State University Press, Ames, 1969. 270 p.

Descriptors: *Flood protection, *Non-structural alternatives, *Iowa, Flood plain zoning, Land use, Land management, Mapping, Data collections, Planning, Regulation, Flood plain insurance, Floodways, River basin development, Urbanization.
Identifiers: Flood plain management.

Comprehensive planning of flood plains is a clear prerequisite to successful control and regulatory phases of flood plain management. This seven-part volume brings together in one integrated text the available information concerning the many phases of flood plain management. Part I presents the philosophy and need for flood plain management. Part II presents the physical flood problem and the future flood potential in Iowa. Part III is devoted to the development of action programs for flood plain management. Part IV deals with the planning role and its many facets. Part V presents the legal aspects of flood plain management. Part VI is devoted to technical flood plain information studies. Part VII contains two reports on the success of management programs in other states. (See also W70-09254 and W70-09255). (Knapp-USGS)
W70-09253

FLOODS IN IOWA,
Geological Survey, Iowa City, Iowa.
For primary bibliographic entry see Field 02E.
W70-09254

FLOOD PLAIN MAPPING BY THE U. S. GEOLOGICAL SURVEY,
Geological Survey, Champaign, Ill.
D. W. Ellis.
In: Flood Plain Management - Iowa's Experience, Papers presented at Conference on Flood Plain Management, 6th Water Resources Design Conference, Jan 23-25, 1968, Iowa State University; published by Iowa State University Press, Ames, p 197-206, 1969. 10 p, 15 ref.

Descriptors: *Floods, *Mapping, *Iowa, *United States, Maps, Flood protection, Warning systems, Data collections, Hydrologic data, Frequency analysis, Stage-discharge relations, Water levels, Profiles, Planning, Flood plain zoning, Flood control, Non-structural alternatives.
Identifiers: USGS Hydrological Atlases.

Effective flood plain management requires a knowledge of the magnitude and frequency of floods to be expected and of the areas that will be inundated. The series of flood inundation reports (hydrologic atlases) of the USGS are intended to aid individuals and agencies responsible for making planning decisions by providing this needed hydrologic data. Components of the reports are the topographic map, a history of past floods, a flood frequency diagram, flood profiles, an oblique aerial photograph taken during the flood, and a brief explanatory text. The flood atlases present hydrologic data concerning the extent, depth, and frequency of flooding that are essential for an appraisal of hazards involved in development of flood plains. The atlases are useful in establishing programs of flood plain management, preparing building and zoning regulations, locating waste disposal facilities, purchasing open space, developing recreational areas, and managing surface water in relation to groundwater resources. (See also W70-09253). (Knapp-USGS)
W70-09255

FLOOD DAMAGE PREVENTION.
Tennessee Valley Authority, Knoxville.
For primary bibliographic entry see Field 10.
W70-09364

FLOOD PLAIN INFORMATION, COYOTE CREEK, SAN FRANCISCO BAY TO ANDERSON RESERVOIR, SANTA CLARA COUNTY, CALIFORNIA.
Corps of Engineers, San Francisco, Calif.
For primary bibliographic entry see Field 04A.
W70-09365

NATIONAL INSTITUTE OF ECOLOGY: AN INQUIRY, VOLUMES 1 AND 2.
Ecological Society of America, Durham, N.C., and Peat, Marwick, Mitchell and Co.

Ecological Society of America Feasibility Study Report, March 25, 1970. 77 p, 2 fig, 17 tab. NSF Grant GB-6890-001.

Descriptors: *Ecology, *Institutions, Administrative agencies, Administration, Universities, Governments, Political aspects, Legal aspects, Research and development.
Identifiers: National Institute of Ecology (Proposed).

This study was made to determine whether the establishment of a National Institute of Ecology can enhance the level of ecological capability relative to that obtainable through the allocation of comparable resources to currently established organizations. It is proposed that the results of this study show that such an institute is both needed and feasible. In response to the expressed desires of many people in varied interest groups, the establishment of a National Institute of Ecology could provide a focus for the concentration of ecological activity. Its establishment could create the supportive and administrative vehicle for the continuation of the U. S. International Biological Program. It could provide manpower, facilities, and organization. It could provide direct and needed assistance to research and educational programs. It could serve as a national center for the storage and coordinated use of the data of ecology, help to standarize data collection and interpretation techniques, and, in general, make those data and techniques of maximum benefit to science and society. (Knapp-USGS)
W70-09366

6G. Ecologic Impact of Water Development

ELECTRIC POWER - IMPACT ON THE ENVIRONMENT,
California Public Utilities Commission.
For primary bibliographic entry see Field 06B.
W70-09020

MAJOR ELECTRIC POWER FACILITIES AND THE ENVIRONMENT,
Edison Electric Inst., N.Y.
Robert N. Coe.
Amer Power Conf, Chicago, Ill, Apr 1970. 17 p.

Descriptors: Aesthetics, *Environment, Project planning, Safety, *Electric power, Electric power demand, Electric power production, Air pollution, Sites, *Reliability, Economics, Switchyards (Electrical), Transmission lines, Substations (Electrical), Transmission towers, Powerplant, Locations, Recreation facilities, Planning, *Public opinion.
Identifiers: Living standards, Pollution control, Beautification.

Environmental problems of the utility industry, accompanied by regulatory and court delays that are inhibiting reliability standards in some areas, are considered and solutions presented. Electric power requirements of the nation have doubled every 10 yr. The future indicates a continued growth as the standard of living improves. Planning and installing major electric power facilities needed to meet this growth require full consideration of environmental factors. Growth in facilities must be accomplished on a timely and orderly basis if an adequate and reliable electric power supply is to continue. Major electric power facilities include generating stations, transmission lines, large substations, and switching centers. Problems associated with building these facilities are: (1) engineering and physical, (2) environmental, and (3) economic. Electric utilities should make all reasonable efforts to enhance the scenic and aesthetic values of project areas. Personnel responsible for location, design, construction, and operation of facilities should be sensitive to their environmental responsibilities and to their responsibility for providing adequate, economic, and reliable electric service. (USBR)
W70-09048

ENVIRONMENTAL CHANGES PRODUCED BY COLD-WATER OUTLETS FROM THREE ARKANSAS RESERVOIRS,
Arkansas Univ., Fayetteville. Water Resources Research Center.
Carl E. Hoffman, and Raj V. Kilambi.
Available from NTIS as PB-193 675, $3.00 in paper copy, $0.65 in microfiche. Arkansas Univ. Water Resources Research Center, Publication No. 5, 1970. 169 p, 10 tab, 15 fig, 65 ref, 10 append. OWRR Project A-001-ARK (8).

Descriptors: *Tailwater, *Temperature, *Current (Water), *Trout, Phytoplankton, Zooplankton, Benthic fauna, Chironomidae, Oligochaetes, Isopods, Amphipoda, Mayflies, Chrysophyta, Cyanophyta, Chlopophyta, *Fish, Cold-water fish, Arkansas, Benthos, Invertebrates.
Identifiers: Trichoptera, Buffalo River (Arkansas), Kings River (Arkansas), Chironomidae.

Water qualities of two natural streams (Buffalo and Kings Rivers), one new coldtailwater (Beaver), and two old coldtailwaters (Norfork and Bull Shoals) in northwestern Arkansas were studied from July 1965 through October 1968. The essential difference between the old coldtailwaters and natural streams is a change in water quality which allows the development of a new productive ecological environment. Features which typify the old tailwaters are as follows: (1) relatively homoiothermal temperatures; (2) stream beds scoured by strong hydroelectric power generation currents; (3) abundant phytoplankton and benthic macroinvertebrates; and (4) absence of warm water game fishes. Environmental factors characterizing natural streams are as follows: (1) high summer temperatures; (2) seasonal and individual current fluctuations at the various stations; (3) a greater variety of benthic macroinvertebrates and ichthyofauna; (4) abundant zooplankters; and (5) a tendency toward an equal distribution of the phyla Chrysophyta, Cyanophyta, and Chlorophyta. By October 1968, the new Beaver coldtailwater had lost all of its warm-water characteristics but had not developed the biotic features of the old tailwaters.
W70-09344

ENVIRONMENTAL QUALITY.
Council on Environmental Quality, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-09347

PROCEEDINGS WORKSHIP ON MOSQUITO CONTROL IN NORTH CAROLINA,.
North Carolina Water Resources Research Inst., Raleigh.

Available from NTIS as PB-193 719, $3.00 in paper copy, $0.65 in microfiche. Report No 36, Water Resources Research Institute, University of North Carolina, 1970. 144 p. OWRR Project A-999-NC (17).

Descriptors: *Mosquitoes, Aquatic insects, Public health, Aquatic habitats, Entomology, *Insect control, Insecticides, Larvicides, *Pesticides, *Water management, Drainage, Insect physical control, North Carolina.
Identifiers: Mosquito control drainage, Mosquito control impoundment.

The objectives of this workshop held on May 4, 1970 at Rangemont, North Carolina, were to explore present mosquito control practice, transition away from persistent pesticides, minimization of ecological impact, integration of mosquito control with water resource management, program coordination, and develop recommendations concerning changes in the program together with research and educational needs. Participants included representatives of federal and state agencies and electric utilities concerned with mosquito control and its implications to water resource management. This is the fourth in a series of research workshops sponsored by the Institute to increase communication between research users and researchers o water resource problems and research need (Howells-Univ. of North Carolina)
W70-09421

SCENIC RIVERS IN MARYLAND.
Maryland Dept. of State Planning, Baltimore.

Available from NTIS as PB-191 288, $3.00 i paper copy, $0.65 in microfiche. State Plannin Dept. Pub 161, Mar 70. 42 p.

Descriptors: *Wild rivers, Conservation.
Identifiers: Scenic Rivers.

The report represents the first in a series of annu findings and recommendations to the General A sembly from the Maryland Scenic Rivers Revie Board concerning the designation of Scenic Rive in Maryland. Five rivers are recommended for off cial Scenic River designation. When approve these rivers would represent the beginning of Scenic Rivers System for Maryland.
W70-09448

07. RESOURCES DATA

7A. Network Design

A PROPOSED STREAMFLOW DATA PRO GRAM FOR MAINE,
Geological Survey, Augusta, Maine.
G. S. Hayes, and R. A. Morrill.
U S Geological Survey Open-file report, 1970. 3 p, 2 fig, 4 tab, 6 ref, append.

Descriptors: *Data collections, *Hydrologic data *Streamflow, *Network design, *Maine, Statistica methods, Streamflow forecasting, Regression anal ysis, Stream gages, Gaging stations, Planning Discharge measurement.
Identifiers: Streamflow data.

An evaluation of the streamflow data available i Maine was made to provide guidelines for planning future programs. The basic steps in the evaluatio procedure were (1) definition of the longterm goal of the streamflow data program in quantitative form, (2) examination and analysis of all available data to determine which goals have already bee met, and (3) consideration of alternate program and techniques to meet the remaining objectives. I was found that many of the goals could be met b generalization of the data for gaged basins by regression analysis. This indicates that change could be made in the present data program tha would allow emphasis to be placed on attaining th goals that have not been met. A streamflow data program based on the guidelines developed in thi study is proposed. (Knapp-USGS)
W70-09353

7B. Data Acquisition

AN ELECTRO-OPTICAL PROBE FOR MEA SUREMENT OF SUSPENDED SEDIMENT CON CENTRATION,
Iowa Univ., Iowa City.
For primary bibliographic entry see Field 02J.
W70-09026

RUNOFF SYNTHESIS FOR RAIN-ON-SNOW BASIN,
Corps of Engineers, Portland, Oreg. North Pacific Div.
For primary bibliographic entry see Field 02E.
W70-09027

USE OF TRACERS IN HARBOR, COASTAL AND OCEAN ENGINEERING,
Norges Tekniske Hoegskole, Trondheim.
P. Bruun.

Eng Geol, Vol 4, No 1, p 73-88, Jan 1970. 16 p, 24 fig, 1 tab, 15 ref.

Descriptors: *Tracers, *Radioisotopes, *Coastal engineering, *Harbors, *Oceans, *Oceanography, Rivers, Bibliographies, Methodology, Foreign research, Underwater construction, Reviews, Sedimentation, *Sediment transport.
Identifiers: *Radioactive tracers, *Fluorescent tracers, Norway, Steady-dilution method, Space-integration method.

Radioactive and fluorescent tracers have been used for over 10 yr, and usage is being expanded by improvement in existing fields and new applications. Use now covers a wide range of fields including harbor, ocean, coastal and river engineering, littoral drift, dredging technology, and pollution control. A history of the development of methodology for using radioactive and fluorescent tracers is outlined and examples of application are given. Radioactive and fluorescent tracers are compared. Pertinent aspects of tracer technology and methods of analyses for determining drift pattern and quantity are discussed. Underwater TV may be useful, particularly if the problem of underwater exitation of fluorescent tracers is solved. A list of literature on tracer projects in various fields of science and technology is included. Has 15 references. (USBR)
W70-09029

ACOUSTIC SUBBOTTOM PROFILING SYSTEMS, A STATE-OF-THE-ART SURVEY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 02A.
W70-09176

P-N JUNCTIONS--A TOOL FOR TEMPERATURE MEASUREMENT,
Battelle Memorial Inst., Richland, Wash. Earth Sciences Section.
Carl G. Enfield, and John M. Tromble.
Water Resources Research, Vol 6, No 3, p 981-985, June 1970. 5 p, 5 fig, 1 tab.

Descriptors: *Thermometers, *Instrumentation, Calibrations, Temperature, Electronic equipment.
Identifiers: P-N junction thermometers.

Silicon semiconductors were investigated for use as temperature transducers between 25 and 75 deg C and were found to have good stability, linearity, and high sensitivity. When one ma of forward current was applied to a diode, a sensitivity of approximately 1.9 mv/deg C was obtained with a forward voltage drop of approximately 600 mv. (Knapp-USGS)
W70-09212

DISPERSION PREDICTION FROM CURRENT METERS,
Ontario Water Resources Commission, Toronto. Water Quality Surveys Branch.
For primary bibliographic entry see Field 02E.
W70-09219

MEASUREMENT OF THE THERMAL CONDUCTIVITY OF FROST BY A TRANSIENT HOT-WIRE TECHNIQUE,
North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
For primary bibliographic entry see Field 02C.
W70-09233

COMPARATIVE STUDY OF THE WATER BALANCE IN THE AERATED ZONES WITH RADIO-ACTIVITE METHODS AND WEIGHABLE LYSIMETER,
Rijksfaculteit der Landbouwwetenschappen, Ghent (Belgium).
For primary bibliographic entry see Field 02G.
W70-09263

MEASURING SOIL MOISTURE IN THE BRENIG CATCHMENT: PROBLEMS OF USING NEUTRON SCATTER EQUIPMENT IN SOIL WITH PEATY LAYERS,
The Water Research Association, Medmenham (England).
For primary bibliographic entry see Field 02G.
W70-09264

AN INSTRUMENT FOR MEASURING SOIL MOISTURE BY NEUTRON SCATTERING,
Swedish Meteorological and Hydrological Inst., Stockholm (Sweden).
Todor Milanov.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 88-95, 1968. 8 p, 6 fig, 7 ref.

Descriptors: *Soil moisture meters, *Nuclear moisture meters, *Calibrations, Moisture meters, Soil moisture, Instrumentation, Moisture content, Nuclear meters.
Identifiers: *Neutron-scatter moisture meters.

At the Swedish Meteorological and Hydrological Institute the neutron method has for some years been used for studies on soil moisture by means of a Danish apparatus. This report deals with the measuring equipment, sources of error, calibration technique, etc. The moisture probe is equipped with a 5 mC Ac-Be neutron source, combined with a scintillation crystal of Lithium Iodide as detector. The maximum error for 160 measurements made by the moisture probe in its standard was found to be about 1%, corresponding to a relative error of 0.5%. The calibration was made in moisture models, made of fine sand mixed with a substance containing crystal water. Some soil moisture measurements made in the field in a homogeneous soil are reported. (See also W70-09266). (Knapp-USGS)
W70-09265

CHANGES IN THE MOISTURE CONTENT OF THE TOPSOIL AS MEASURED WITH A NEUTRON MOISTURE GAUGE,
Institute of Technology, Stockholm (Sweden).
For primary bibliographic entry see Field 02G.
W70-09266

THE DETERMINATION OF SOIL MOISTURE WITH THE NEUTRON SCATTERING METHOD IN FINLAND,
Finnish Hydrological Office, Helsinki.
J. Virta.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 105-108, 1968. 4 p, 3 tab, 2 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, *Calibrations, Mositure meters, Soil moisture, Instrumentation, Mositure content, Nuclear meters, Evapotranspiration.
Identifiers: Neutron-scatter moisture meters, Finland.

The neutron method for measurements of soil moisture has been used in Finland from the year 1964. The Hydrological Office has had two measuring sites in forest, with six or seven measuring tubes. In each tube the moisture has been determined at different depths. The measurements have been carried out once a month during the winter and twice monthly during the summer. The purpose is to determine the fluctuations of soil moisture and to examine the possibility of computing the evapotranspiration from these measurements. The results of the measurements are presented and the effects of the instability of the measuring system and the irregular areal distribution of the change of soil moisture content are discussed. (See also W70-09268). (Knapp-USGS)
W70-09267

NEUTRON MOISTURE METER FOR SALINE SOILS,
All-Union Scientific and Research Institute of Hydrotechnics and Reclamation (USSR).
L. I. Beskin, V. A. Emelyanov, and B. M. Kondratyev.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 109-112, 1968. 4 p, 3 fig.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, *Calibrations, Moisture meters, Soil moisture, Instrumentation, Moisture content, Nuclear meters, Gamma rays.
Identifiers: *Epithermal neutron moisture meters.

The principle of action of well-known neutron moisture meters is based on detecting thermal neutrons, which appear when rapid neutrons are being slowed down by hydrogen nuclei. However, the moisture meters with such detectors are sensible to changes in the percentage of chloride, boron, lithium and other excessively strong absorbers of neutrons, which may result in considerable errors in measuring the moisture of soils containing these elements. It is possible to reduce the action of the excessively strong absorbers by means of detection of epithermal neutrons, but this will deteriorate sensitivity of the moisture meters. Best suited for the job is the method of measuring the moisture of soils by total density of thermal neutrons and the gamma photons in a cadmium screen. The method is, under certain conditions, practically insensitive to any changes in percentage of chloride and considerably less sensitive to any changes in percentage of other excessively strong absorbers. When moisture is being measured by the moisture meter with such a detector, a single calibration may be used on all types of soils of nonorganic origin, provided the admissible absolute error is plus or minus 2%. (See also W70-09269). (Knapp-USGS)
W70-09268

MEASUREMENT OF SOIL MOISTURE FROM THE TEMPERATURE GRADIENT,
Forest Research Inst., Budapest (Hungary).
T. Foldi, and L. Szonyi.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 113-119, 1968. 7 p, 6 fig, append.

Descriptors: *Soil moisture meters, *Thermal conductivity, Instrumentation, Calibrations, Moisture meters, Soil temperature, Thermal properties, Soil moisture.
Identifiers: Temperature gradient moisture meters.

A new method for measuring soil moisture is described. Near a heat transmitter with stabilized heat flux, thermal conductivity of the soil can be determined and recorded from the temperature gradient. Using a corrosion resistant transmitter introduced into the soil and ensuring constant calibration conditions, soil moisture can be measured and recorded. For determining soil moisture a new electric method was developed, which is independent from the concentration of the soil solution, thus being suitable for measuring and recording moisture in soils of different structure. The measuring probe is weather proof, resistant to mechanical effects during installation into the soil, and to influences of temperature for extended periods. (See also W70-09269). (Knapp-USGS)
W70-09269

SOME METHODS FOR THE DETERMINATION OF SOIL MOISTURE AND BALANCE MEASURING,
Hydraulic Research Inst., Prague (Czechoslovakia).
Jiri Vasa.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International

Association of Scientific Hydrology, Publication No 82, p 119-124, 1968. 6 p, 3 fig, 1 tab, 10 ref.

Descriptors: *Soil moisture, *Measurement, *Sampling, *Electrical resistance, Soil moisture meters, Laboratory tests, On-site tests, Water balance, Hydrologic budget, Energy budget, Rain gages, Calibrations.
Identifiers: Soil moisture determination.

Methods of measuring soil moisture and water balance used in Czechoslovakia are reviewed. Sampling, electrical resistivity methods, water budget, and energy budget methods are briefly discussed. A rain gage calibration table is included to aid in estimating the proportion of gaged rain actually reaching the ground. Soil sampling equipment is described. (See aslo W70-09271). (Knapp-USGS)
W70-09270

POLISH ISOTOPE APPARATUS FOR RESEARCH ON SOIL MOISTURE,
Hanna Filipkowska.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 124-131, 1968. 8 p, 3 fig, 9 ref.

Descriptors: *Nuclear moisture meters, *Soil moisture meters, *Calibrations, Moisture meters, Soil moisture, Instrumentation, Moisture content, Nuclear meters.
Identifiers: *Poland, Soil moisture measurement, Neutron-scatter moisture meters.

Polish probes manufactured by the Bureau for the Nuclear Technique Installation which serve to measure soil moisture were described. They allow determination of the water content in the surface layer and at depth. The basic part of each probe is the source of fast neutrons and the GEIGER-MULLER counter covered with cadmium. As a source of fast neutrons the mixture Pu + Be or Po + Be has been used. To use the probes in practice one should define for each of them the dependence between the impulse intensity recorded on the scaler and the soil moisture. When the probe calibration is performed one should take into account the influence of bulk density of the ground on moisture and the eventual errors due to contents of elements which strongly absorb neutrons in the ground mixture.s. Soil moisture measurements may be performed within the range of 0-45% of volume moisture, with accuracy of 0.3-1.5, according to the manufacture data. The results obtained always refer to a sphere with a radius of 15-25 cm. (See also W70-09272) (Knapp-USGS)
W70-09271

NUCLEAR TECHNIQUES IN HYDROLOGICAL INVESTIGATIONS IN THE UNSATURATED ZONE,
International Atomic Energy Agency, Vienna (Austria). Div. of Research and Laboratories.
E. Halevy.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 131-145, 1968. 15 p, 5 ref, 2 append.

Descriptors: *Nuclear moisture meters, *Radioisotopes, *Moisture meters, *Soil moisture meters, Calibrations, Soil moisture, Soil water, Instrumentation, Moisture content, Nuclear meters, Surveys, Reviews.
Identifiers: Neutron-scatter moisture meters.

Nuclear and isotopic techniques which may aid in investigations of the unsaturated zone are discussed. The discussion includes methods for the determination of soil water content and methods for investigation of the movement of soil moisture. The recommendations of the joint FAO/IAEA conference on the Use of Isotopes and Radiation Techniques in Soil Moisture and Irrigation Studies held at Vienna in March 1966 are annexed. A list of definitions of terms relating to neutron soil moisture gages is also given. (See also W70-09273) (Knapp-USGS)
W70-09272

CALIBRATION AND EVALUATION OF A WIDE RANGE METHOD FOR MEASURING MOISTURE STRESS IN FIELD SOIL SAMPLES,
Geological Survey, Denver, Colo. Water Resources Div.
I. S. McQueen, and R. F. Miller.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 147-155, 1968. 9 p, 2 fig, 2 tab, 16 ref.

Descriptors: *Moisture stress, *Soil moisture meters, Soil moisture, Calibrations, Instrumentation, Laboratory tests, On-site tests, Membrane processes, Osmosis, Membranes.
Identifiers: Moisture stress meter.

A moisture stress measurement for each gravimetric soil moisture sample, made possible by development of a wide-range method using filter paper as stress sensors, is supplying answers to some difficult hydrologic problems. The moisture stress existing in a gravimetric sample can be measured within 2 percent and the range covered is from 0 to 1500 bars. Calibration of the method was accomplished in the laboratory and in the field using saturated salt solutions (15 to 1500 bars), a pressure membrane extractor (1 to 15 bars), a pressure plate assembly (0.1 to 1 bars), and equilibrium above a water table (0 to 0.2 bars). Disturbance of the sample has little effect on results at stress levels above 0.2 bars. At stress levels below 0.2 bars, special handling and sampling techniques should be used to obtain samples with minimum disturbance. (See also W70-09274) (Knapp-USGS)
W70-09273

HYDRAULIC AND PRESSURE HEAD MEASUREMENT WITH STRAIN GAUGE PRESSURE TRANSDUCERS,
Illinois Univ., Urbana; and Agricultural Research Service, Urbana.
A. Klute, and D. B. Peters.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 156-165, 1968. 10 p, 6 fig, 8 ref, append.

Descriptors: *Soil water movement, *Soil moisture meters, Tensiometers, Instrumentation, Calibrations, Moisture meters, Soil moisture, Soil water, Moisture tension.
Identifiers: Strain-gage tensiometers.

Sensitive, responsive tensiometers are highly useful in laboratory and field studies of water movement in unsaturated soil. Strain gage pressure transducers of the diaphragm type have been incorporated into a tensiometer system that has a short response time, is capable of detecting tension changes as small as a few millimeters of water and has the advantage of an electrical output that can be recorded. Construction details, precautions to be observed in use and operational procedures are given for direct reading and null modes of measurement. A manifold for the use of a single transducer with a number of tensiometer cups and the possible use of the tensiometer in field measurements are described. (See also W70-09275) (Knapp-USGS)
W70-09274

DIRECT MEASUREMENT OF MOISTURE POTENTIAL: A NEW TECHNIQUE,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
A. J. Peck, and R. M. Rabbidge.
French resume. In: Water in the Unsaturated Zon
Vol I, Proceedings of the Wageningen Symposiur
The Netherlands, June 19-25, 1966, Internation
Association of Scientific Hydrology, Publicatio
No 82, p 165-170, 1968. 6 p, 1 fig, 4 ref.

Descriptors: *Soil moisture meters, *Tensiometer
Instrumentation, Calibrations, Moisture meter
Soil moisture, Soil water, Moisture tension, Mem
brane processes, Osmosis, Membranes.
Identifiers: Osmotic tensiometer.

Although conventional tensiometers are simple an
capable of yielding fairly precise data, their usefu
ness is frequently limited by their range. Gypsum c
nylon blocks, which cover a much greater range c
moisture potentials, exhibit hysteresis and cor
sequently may be in considerable error. A ne
technique for direct measurement of moistur
potential over the full range of agricultural an
hydrological importance has been developed. Th
basis of this technique is that an osmotic solution
used to depress the zero of moisture potential in th
measuring instrument by a known amount. Water
exchanged between the soil and the instrument vi
a semi-permeable membrane until an equilibriur
of free energy of water is reached. The change c
free energy within the instrument can be designe
to be almost entirely a result of a change of pres
sure which actuates a pressure transducer. The in
strument can be adapted to measure either matri
or total potential. Tests of early models of the in
strument indicate response time constants of only
few minutes. (See also W70-09276) (Knapp
USGS)
W70-09275

**CAPILLARY CONDUCTIVITY DATA ESTI
MATED BY A SIMPLE METHOD,**
Institute for Land and Water Managemen
Research, Wageningen (Netherlands).
G. P. Wind.
French resume. In: Water in the Unsaturated Zone
Vol I, Proceedings of the Wageningen Symposium
The Netherlands, June 19-25, 1966, Internationa
Association of Scientific Hydrology, Publicatio
No 82, p 181-191, 1968. 11 p, 6 fig, 4 tab, 3 ref.

Descriptors: *Capillary conductivity, *Estimating
*Laboratory tests, Bouyoucos blocks, Permeame
ters, Soil water movement, Percolation, Unsatu
rated flow, Evaporation, Drying, Flow, Porou
media, Moisture stress.
Identifiers: Capillary conductivity estimation.

A simple method is given for estimating capillary
conductivity by study of soil samples in the labora
tory. A vertical column of soil is allowed to
evaporate at the top; all other sides are completely
closed. Every day the total weight of the column is
read and determinations are made of the moisture
content and moisture tension at a number of
depths. The velocity of flow for different depths
can be calculated from the changes in moisture
content and weight. The potential gradient can be
read from the moisture tension readings, making it
possible to calculate the capillary conductivity. A
difficulty is that a pF-curve is needed when
moisture content or moisture tension is deter-
mined. In the latter case, used in this paper, the
total amount of moisture in the column determined
from tension data and the pF-curve does not agree
with the amount determined from the total weight.
This means the flow velocity cannot be calculated
exactly. The reason is that the pF-curves used lack
sufficient reproducibility. They can be fitted to the
soil column used by the iteration technique
described. The capillary conductivity values, deter-
mined with the aid of Bouyoucos' electrical nylon
units, are fairly accurate at moisture tensions
between 0.1 to 20 atmospheres. Below 0.1 at-
mosphere they lack accuracy. An advantage of this
method is, that it is a true imitation of some
moisture flow processes which occur in nature and
to which knowledge of the capillary conductivity
has to be applied. (See also W70-09278) (Knapp-
USGS)
W70-09277

IFFUSIVITY DETERMINATION BY A NEW UTFLOW METHOD,
ommonwealth Scientific and Industrial Research rganization, Canberra (Australia). Div. of Plant ndustry.
. J. Peck.
rench resume. In: Water in the Unsaturated Zone, ol I, Proceedings of the Wageningen Symposium, he Netherlands, June 19-25, 1966, International ssociation of Scientific Hydrology, Publication o 82, p 191-202, 1968. 12 p, 7 fig, 12 ref.

escriptors: *Soil moisture movement, *Diffusivi-, Flow, Porous media, Laboratory tests, Per-eameters, Mathematical studies, Membrane rocesses, Osmosis, Membranes, Moisture tension, nsaturated flow.
dentifiers: Soil diffusivity.

method of deducing soil moisture diffusivities om laboratory outflow data is described. This ethod involves the matching of outflow data to a ngle theoretical curve regardless of the mem-rane conductance. The new method involves an ssumption of constant diffusivity over the range of oisture contents involved in a 'step'. In order that e experiments should approximately satisfy this ssumption, it is usual to use only small 'steps'. ata obtained from some of the outflow experi-ents reported, wherein the diffusivity varied by p to an order of magnitude, matched the theoreti-l curve as well as small step data. Diffusivities educed from these large step experiments agreed ell with the integrated means of small step dif-sivities. It appears that, with the new analysis the se of large steps is reasonable provided that the embrane conductance is greater than the hydrau-c conductivity of the test piece. An analysis of er-rs arising with the new method suggests that ossible errors in diffusivity of as little as 30% hould be readily obtainable and experimental data upport this. This is a significant improvement on revious data which indicate errors of up to an rder of magnitude. It is suggested that sample ariability may be the basis for such large errors. See also W70-09279) (Knapp-USGS)
V70-09278

OIL WATER DIFFUSIVITY AND WATER CONTENT DISTRIBUTION DURING OUTFLOW EXPERIMENT,
California Univ., Davis. Dept. of Water Science nd Engineering; Oklahoma State Univ., Stillwater; rizona Univ., Tucson; and North Dakota State Univ., Fargo.
or primary bibliographic entry see Field 02G.
V70-09280

N INFILTRATION METHOD FOR THE ETERMINATION OF THE CAPILLARY CONUCTIVITY OF UNDISTURBED SOIL CORES,
nstitute for Land and Water Management esearch, Wageningen (Netherlands).
. Wesseling, and K. E. Wit.
rench resume. In: Water in the Unsaturated Zone, ol I, Proceedings of the Wageningen Symposium, he Netherlands, June 19025, 1966, International ssociation of Scientific Hydrology, Publication o 82, p 223-234, 1968. 12 p, 11 fig, 1 tab, 18 ref.

escriptors: *Capillary conductivity, *Soil water ovement, *Laboratory tests, Permeameters, Infil-rometers, Saturated flow, Unsaturated flow, Soil exture, Tensiometers, Sampling, Cores.
dentifiers: Capillary conductivity measurement, oil core samples.

method for the determination of the capillary onductivity was developed based onthe infiltra-ion of water into vertical columns. By using accu-ate drip feeding systems and small tensiometers ith a soil filling, instead of a porous cup it is possi-le to measure suction gradients and to compute K-values simply. The method developed was applied o both disturbed soil samples and to undisturbed ores. For the sandy material a relatively wide ange of suctions was found in which the capillary onductivity remains equal to the value of satura-tion. A good agreement was found between the point where the moisture content drops rapidly in the pF-curve with increasing suction and the point where the capillary conductivity drops with increasing suctions. For the finer textured soils the range of constant K-value is practically absent. The results of the disturbed sandy samples do not fit in the general equation proposed by Rijtema (1965). For the undisturbed samples, however, a fairly good agreement was found. (See also W70-09282) (Knapp-USGS)
W70-09281

DIVERGENCES BETWEEN EXPERIMENTAL AND THEORETICAL VALUES OF CAPILLARY DIFFUSIVITY (FRENCH),
State Coll. of Agronomical Sciences, Gembloux (Belgium).
For primary bibliographic entry see Field 02G.
W70-09285

DETERMINATION OF PORE SIZE BY THE AIR BUBBLING PRESSURE METHOD,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. P. Stakman.
French resume. In: Water in the Unsaturated Zone, Vol I, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 82, p 366-372, 1968. 7 p, 2 fig, 16 ref.

Descriptors: *Porosity, *Porous media, *Laboratory tests, *Instrumentation, *Bubbles, Permeability, Soil water movement, Groundwater movement, Unsaturated flow, Surface tension, Wetting, Capillary action, Pore pressure, Hydraulic gradient, Pressure, Permeameters, Tensiometers.
Identifiers: *Pore size, Pore size determination, Air-bubble permeameters.

The air bubbling pressure method is often used to determine the largest pore size of ceramic material whose geometrical pattern is unchangeable. A regularly increasing pressure is applied to the water-saturated porous material. The pressure at which air bubbles start to escape from the material is read from a manometer and is called the air bubbling pressure. From this the equivalent diameter of the largest passageway can be calculated. This method is not only useful to check the maximum pore size of porous plates or membranes in soil physical research but makes it possible to relate pore size of sandy soils to the hydraulic conductivity and other properties. The air bubbling pressure may serve as the starting-pressure for the determination of the capillary conductivity. For sand separates the maximum air bubbling pressure was reached with sample-heights of 8 to 14 mm. (See also W70-09298). (Knapp-USGS)
W70-09297

ESTIMATING STORAGE CAPACITY IN DEEP ALLUVIUM BY GRAVITY-SEISMIC METHODS,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
For primary bibliographic entry see Field 02F.
W70-09373

EXPERIENCES WITH SNOW PILLOWS IN NORWAY,
Norwegian Water Resources and Electricity Board, Oslo.
For primary bibliographic entry see Field 02C.
W70-09375

A GAMMA-PHOTONEUTRON METHOD FOR LABORATORY STUDIES OF SOIL WATER,
Du Pont de Nemours (E. I.) and Co., Aiken, S.C.
For primary bibliographic entry see Field 02G.
W70-09382

MEASUREMENT OF WATER POTENTIAL AND OSMOTIC POTENTIALS IN SOIL WITH A COMBINED THERMOCOUPLE PSYCHROMETER AND SALINITY SENSOR,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 02G.
W70-09384

DETERMINATION OF THE VELOCITY AND DIRECTION OF GROUNDWATER FLOW BY RADIOISOTOPES,
Middle Eastern Regional Radioisotope Center for the Arab Countries, Cairo (Egypt).
For primary bibliographic entry see Field 02F.
W70-09386

MINING AND GROUNDWATER GEOPHYSICS/1967.
Geological Survey of Canada, Ottawa (Ontario).

Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, L. W. Morley, editor. Canada Geological Survey Economic Geology Report No 26, 1970. 722 p.

Descriptors: *Conferences, *Geophysics, *Exploration, *Groundwater, Surveys, Mapping, Water resources development, Electrical studies, Seismic studies, Magnetic studies, Borehole geophysics, Data collections, Hydrologic data, Hydrogeology, Geothermal studies, Gravity studies, Radioactivity, Remote sensing.
Identifiers: Geophysics symposium.

This volume is a record of the proceedings of the Canadian Centennial Conference on Mining and Groundwater Geophysics, held at Niagara Falls, Canada in October, 1967. One of the objects of the conference was to produce an up-to-date reference text on Mining and Groundwater Geophysics. The general subjects discussed include the state of the art, mapping, metals exploration, groundwater exploration, and national facilities for geophysical work. (See also W70-09393 thru W70-09409). (Knapp-USGS)
W70-09392

GEOPHYSICS IN PROSPECTING AND EXPLORATION FOR MINERAL DEPOSITS IN THE U.S.S.R.,
Ministerstvo Geologii, Moscow (USSR).
V. V. Fedynsky, V. V. Brodovoi, and V. A. Gelamkov.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Report No 26, p 667-687, 1970. 21 p, 17 fig, 1 tab, 29 ref.

Descriptors: *Geophysics, *Exploration, *Surveys, Reviews, Foreign research, Economics, Projects, Research and development, Groundwater, Borehole geophysics, Water resources development.
Identifiers: *USSR.

Geophysical methods are widely used in the Soviet Union in the exploration and prospecting of deposits of metallic and nonmetallic minerals and rare earths as well as groundwater. The organization of geophysical exploration is based on the principle of the interrelation of geological and geophysical data. Results of geophysical surveys are widely used for the compilation of metallogenetic, tectonic and geological maps. Geophysical methods are used not only in the direct search for orebodies but also in the indirect search, structural-tectonic and lithological features indicating favorable areas for further study. Borehole geophysics is receiving increasing attention, especially X-ray fluorescence, various electrical methods, three-component magnetometry and geochemistry. (See also W70-09392). (Knapp-USGS)
W70-09393

ELECTROMAGNETIC AERIAL SURVEY OF A FRESH WATER-SALT WATER CONTACT IN THE RHONE DELTA (FRENCH),
Bureau of Geologic and Mine Research (France); and Geoterrex Co. (France).
P. Baudoin, G. Durozoy, and M. Utard.
In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 626-637, 1970. 12 p, 12 fig, 1 tab, 7 ref.

Descriptors: *Magnetic studies, *Saline water-freshwater interfaces, *Aquifers, *Groundwater, Geophysics, Remote sensing, Surveys, Aircraft.
Identifiers: Airborne electromagnetic surveys.

The results of an airborne survey on a contact between salty and fresh groundwater previously studied by ground methods are presented. The geology consists of three to four layers, the first and third layer being conductive. The correlation between contour maps of the amplitude of EM anomalies and ground resistivity maps is good and evidence is given of detecting the main fresh-water zones. It is possible, in some cases, from the comparison of the various EM amplitude contour maps corresponding to measurements at various times after the end of the energizing pulse, to approximately determine whether apparent conductivity changes are caused by changes in shallow layers or at depth. More generally, EM maps established from a multitime or multifrequency EM system appear to be as interesting as some conventional resistivity maps obtained with various electrode spacings. The interpretation however is purely qualitative and has to be controlled by ground geophysics. (See also W70-09392) (Knapp-USGS)
W70-09394

GEOPHYSICAL PROSPECTING AND RESEARCH ON UNDERGROUND WATER (FRENCH),
J. J. Breusse.
In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 638-640, 1970. 3 p.

Descriptors: *Exploration, *Geophysics, *Groundwater, Surveys, Borehole geophysics, Electrical studies, Resistivity, Seismic studies, Hydrogeology, Water table, Aquifers.
Identifiers: Groundwater prospecting.

The principal methods which are applied to groundwater investigations and the types of hydrogeological problems to which geophysical techniques can be applied are discussed. The principal electrical methods are: resistivity, profiling, resistivity mapping and electrical sounding. Seismic refraction is generally used to complement electrical methods. The main hydrogeological problems dealt with by geophysics are alluvial formations, perched water-tables, the search for basins, sand-dune aquifers and the reconnaissance studies of aquifers penetrated by saline waters. For structural studies, geophysics can be used for delineating horsts, grabens, water sills, granitic sands and fracture zones. Electrical logging methods have wide application. Still the most widely used geophysical methods in hydrogeology are the lightweight and economical electrical methods. (See also W70-09392) (Knapp-USGS)
W70-09395

GEOPHYSICAL STUDIES IN PERMAFROST REGIONS IN THE U.S.S.R.,
Moscow State Univ. (USSR). Dept. of Geophysics.
A. A. Ogilvy.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 641-648, 1970. 8 p, 9 fig, 1 tab, 1 ref

Descriptors: *Geophysics, *Permafrost, Electrical studies, Seismic studies, Exploration, Resistivity, Velocity, Frozen soil, Frozen ground, Geothermal studies.
Identifiers: USSR, Permafrost geophysics.

Nearly half the territory of the Soviet Union is covered by permafrost. It is widely studied by geophysics, especially be geoelectric methods. The resistivity of frozen soils depends on the ratio of ice and water contained in the pores. Sand resistivity increases sharply when temperature drops below -0.5 deg C. Clay acquires high resistivity with a drop in temperature to from -2 to -6 deg C. The velocity of propagation of elastic waves considerably increases in frozen soils. By electrical soundings the upper and lower surfaces of permafrost can be determined. Measurement of rock resistivity conducted in fixed-time intervals make it possible to determine shifts in the permafrost boundary. Observations on the advance and retreat of permafrost are important for populated areas, mines, hydrotechnical and other engineering projects. (See also W70-09392) (Knapp-USGS)
W70-09396

GEOPHYSICS IN UNITED NATIONS PROJECTS,
United Nations, New York.
J. M. Brown.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 651-657, 1970. 7 p, 1 tab.

Descriptors: *Geophysics, *Exploration, *Groundwater, *United Nations, Projects, Reviews, Surveys, Governments, Water resources development.
Identifiers: Groundwater prospecting.

The United Nations is engaged in conducting large exploration programs in the developing countries throughout the world. Extensive use is made of applied geophysics. The objectives vary but the larger programs are designed to prepare the way for investment by the Government or private sector according to national policy. The geophysical element of these programs usually includes aerial survey followed by ground geophysics together with geological and geochemical surveys. From analysis of the data so obtained further geophysical surveys may be undertaken in order to select drilling targets. Operations include investigations for porphyry copper mineralization, iron ores, potassium deposits and so on. Others are in the field of geothermal energy and in groundwater. Geophysics also features in the establishment of training institutes and in the provision of fellowships. Of the larger programs being undertaken by the United Nations a few are in the final stages and from the analysis of these, sound contributions to economic development can be expected. (See also W70-09392) (Knapp-USGS)
W70-09397

APPLIED GEOPHYSICS IN THE NATURAL ENVIRONMENT RESEARCH COUNCIL IN GREAT BRITAIN,
Institute of Geological Sciences, London (England).
K. C. Dunham.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Report No 26, p 658-666, 1970. 9 p, 1 fig, 39 ref.

Descriptors: *Geophysics, *Exploration, *Surveys, Reviews, Foreign research, Economics, Projects, Research and development, Groundwater, Water resources development.
Identifiers: *United Kingdom.

A short historical review summarizes past activity by United Kingdom organizations in geophysical exploration as applied to economic geology and groundwater both in and around Britain and in programs overseas. The principal methods used a discussed briefly and illustrated by a few mor detailed examples. Organizational changes follow ing the formation in 1965 of the National Enviro ment Research Council are described, with speci reference to integration of the former Geologic Survey of Great Britain and Overseas Geologic Surveys within the new Institute of Geologic Sciences. A forward glance is directed toward identifying projects suitable for future research b governmental organizations, possibly in collabor tion with university and industrial groups. (See als W70-09392) (Knapp-USGS)
W70-09398

THE USE OF SEISMIC REFRACTION AN GRAVITY METHODS IN HYDROGEOLOG CAL INVESTIGATIONS,
Geological Survey, Raleigh, N.C.; and Nort Carolina Univ., Raleigh.
Gordon P. Eaton, and Joel S. Watkins.
French resume. In: Mining and Groundwate Geophysics/1967, Proceedings of Canadian Cen tennial Conference at Niagara Falls, Canada, Oc 1967, Canada Geological Survey Economic Geolo gy Report No 26, p 544-568, 1970. 25 p, 16 fig, tab, 91 ref.

Descriptors: *Seismic studies, *Gravity studie *Aquifers, *Groundwater, *Hydrogeology, Wate resources development, Porosity, Water storage Sediments, Glacial drift, Data collection Hydrologic data, Mapping, Exploration, Subsur face investigations.
Identifiers: Groundwater prospecting.

The capacity of unconsolidated deposits to stor water depends on their porosity, thickness an shape; thus geophysical methods that provide infor mation relating to these factors provide technique for both search and evaluation. Although many fac tors have a bearing on velocity and density, porosi ty is a particularly important factor. Low density and low velocity are a direct indication of high tota porosity and potential water storage capacity, an hence a useful guide to unconsolidated aquifers Under ideal circumstances, the seismic metho provides a means of determining the three-dimen sional geometry of the aquifer, the gross stratig raphy and local lithofacies variations of the aquifer and depth to the water-table. The gravity metho can be used alone as a reconnaissance tool fo evaluating bedrock topography beneath the aquife in some areas, and locally for quantitative estimate of depth to bedrock. Used with the seismic metho or with borehole data, surface measurements o gravity provide a means of determining the average total porosity of the deposit and, in some instances even a measure of specific yield. (See also W70-09392) (Knapp-USGS)
W70-09399

BOREHOLE GEOPHYSICS AS APPLIED TO GROUNDWATER,
Geological Survey, Denver, Colo.
W. Scott Keys.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 598-614, 1970. 17 p, 8 fig, 20 ref.

Descriptors: *Borehole geophysics, *Hydrogeology, *Aquifers, Groundwater, Surveys, Data collections, Electrical studies, Exploration, Logging (Recording), Radioactivity, Resistivity, Subsurface investigations, Instrumentation.
Identifiers: Groundwater prospecting.

The Water Resources Division of the U. S. Geological Survey is conducting research on the application of borehole geophysics to groundwater investigations. The various logging techniques include: natural gamma; gamma-gamma; neutron-gamma; neutron-neutron; spontaneous potential;

single point, short-, and long-normal resistivity; caliper; sonic velocity; flowmeter; radioactive tracer; fluid resistivity; and gradient and differential temperature. Geophysical logs can be interpreted in terms of the geometry, resistivity, bulk density, porosity, permeability, moisture content, and specific yield of water-bearing rocks and the source, movement, and chemical and physical characteristics of water. Geophysical logs are often the only means of obtaining information from old wells and lateral extrapolation of geologic and hydrologic conditions. Logging can partially supplant coring. Data obtained from samples become more meaningful when used with geophysical logs because logs provide continuous average values for a volume of material much larger than that of extracted samples. New lightweight logging equipment is economically compatible with present well costs and with the value of water. (See also W70-09392) (Knapp-USGS)
W70-09400

GEOPHYSICAL PROSPECTING FOR GROUNDWATER IN THE SOVIET UNION,
Moscow State Univ. (USSR).
A. A. Ogilvy.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 536-543, 1970. 8 p, 8 fig, 7 ref.

Descriptors: *Geophysics, *Surveys, *Groundwater, *Water resources development, Permeability, Storage coefficient, Electrical studies, Seismic studies, Borehole geophysics, Density, Nuclear meters, Electrical well logging, Resistivity, Exploration, Subsurface investigations.
Identifiers: USSR, Groudwater prospecting.

Geophysics has been applied to groundwater exploration in the Soviet Union since 1929. The principal groundwater problems dealt with are investigations of permeability and water-bearing properties of rocks, search for groundwater accumulations, and studies of groundwater movement. Electrical prospecting, electrical logging, and to a lesser extent, seismic prospecting are the principal methods used to solve these problems. Geophysical methods are widely used in groundwater studies in permafrost regions covering about 43 percent of the area of the Soviet Union. They are commonly applied in determining the interface between fresh and salt waters near sea shores and particularly in the search for fresh-water lenses that are principal water-supply sources in deserts. (See also W70-09392) (Knapp-USGS)
W70-09401

A REVIEW OF SOME PROBLEMS OF SEISMIC PROSPECTING FOR GROUNDWATER IN SURFICIAL DEPOSITS,
Saskatchewan Univ., Saskatoon.
Kenneth B. S. Burke.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 569-579, 1970. 11 p, 6 fig, 48 ref.

Descriptors: *Seismic studies, *Surveys, *Aquifers, *Hydrogeology, *Groundwater, Water resources development, Water-table, Permeability, Porosity, Sands, Velocity, Data collections, Hydrologic data, Geophysics, Exploration, Subsurface investigations.
Identifiers: Canada, USSR, Groundwater prospecting.

Seismic prospecting is often used in the search for groundwater supplies in surficial deposits. The usual targets in this search are unconsolidated or semiconsolidated deposits of clastic material, confined by less permeable deposits. Besides the normal limitations of the seismic method, three particular problems confront the seismologist. These are: (1) the difficulty of generating simple seismic bodily waves in unconsolidated materials; (2) the lack of a definitive relationship between seismic velocity and a particular deposit; and (3) the much greater significance of errors in small-scale seismic investigation. Amplitude and frequency studies are promising in removing some of the restrictions imposed by the lack of velocity contrasts. In one example such studies provided useful information on the identity and porosity of an aquiferous sand in the USSR. However, an attempt to repeat this experiment under similar conditions in Canada failed, probably because of unavoidable changes in shothole characteristics. The possible role of the electroseismic effect in determining permeability is mentioned. (See also W70-09392) (Knapp-USGS)
W70-09402

INTEGRATION OF GEOPHYSICAL METHODS FOR GROUNDWATER EXPLORATION IN THE PRAIRIE PROVINCES, CANADA,
Research Council of Alberta, Edmonton.
D. H. Lennox, and V. Carlson.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 517-535, 1970. 19 p, 6 fig, 4 tab, 44 ref.

Descriptors: *Geophysics, *Surveys, *Groundwater, *Water resources development, Hydrogeology, Data collections, Hydrologic data, Seismic studies, Resistivity, Electrical studies, Gravity studies, Aquifers, Grasslands, Geology, Exploration, Subsurface investigations.
Identifiers: Canada, Groundwater prospecting.

In the Canadian prairies, geophysics has had two main uses as an aid in groundwater exploration: delineation of the preglacial drainage pattern and mapping the location and extent of buried permeable deposits of Pleistocene and Recent age. Delineation of the preglacial drainage pattern may involve mapping the elevation of the bedrock surface or simply tracing geophysical anomalies associated with preglacial river courses. Seismic refraction has commonly been used for the former purpose, resistivity and gravity for the latter. Resistivity has also proved suitable for mapping the location and extent of the buried permeable Pleistocene and Recent deposits. Considerable effort has been expended on geophysical exploration for groundwater in the Canadian prairies but comparatively little on critical evaluation of the effectiveness of the various methods in a variety of geologic situations. More case-history studies are required to remedy this deficiency and to provide a more reliable picture of the role of each method as a member of an integrated exploration team. (See also W70-09392) (Knapp-USGS)
W70-09403

INTEGRATION OF GEOPHYSICS AND HYDROGEOLOGY IN THE SOLUTION OF REGIONAL GROUNDWATER PROBLEMS,
Water Planning for Israel Ltd., Tel-Aviv.
Z. L. Shiftan.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 507-516, 1970. 10 p, 2 fig.

Descriptors: *Geophysics, *Surveys, *Water resources development, Hydrogeology, Data collections, Hydrologic data, Data processing, Mapping, Water wells, Resistivity, Electrical studies, Gravity studies, Magnetic studies, Exploration, Subsurface investigations.
Identifiers: Israel, Groundwater prospecting.

The present worldwide increase in the demand for groundwater is responsible for the growing number of groundwater exploration and development projects of regional size, requiring accuracy in the evaluation of available resources. For this purpose, an integrated application of geological, geophysical and hydrological methods and test drilling is needed. In such projects, geophysics is employed mainly in coordination with geological studies and drilling, to establish a model of the subsurface structure of the region and the existing aquifers. It also serves as an instrument for the solution of a variety of special hydrological problems, such as groundwater salinity distribution and localization of regions of groundwater flow. (See also W70-09392) (Knapp-USGS)
W70-09404

THE ROLE OF GEOPHYSICS IN THE DEVELOPMENT OF THE WORLD'S GROUNDWATER RESOURCES,
Geological Survey, Denver, Colo.
Don R. Mabey.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 267-271, 1970. 5 p, 5 fig.

Descriptors: *Geophysics, *Surveys, *Groundwater, *Water resources development, Hydrologic data, Data collections, Hydrogeology, Gravity studies, Seismic studies, Electrical studies, Magnetic studies, Exploration, Subsurface investigations.
Identifiers: Groundwater prospecting.

All of the standard airborne, surface, and borehole geophysical methods have found some use in groundwater investigations. Electrical and seismic surveys are the most common surface methods, and electrical and gamma-ray logs the most common borehole methods. However, adequate geophysical support for a diversified groundwater program requires that all of the standard geophysical techniques be available when needed. The trend in groundwater investigations is toward looking at problems on a regional basis rather than to the development of a single well or well field. A properly designed and executed program of geophysics can make a major contribution to programs of this type. The development in recent years of more extensive and better-supported water resource programs has resulted in a greater effort in groundwater geophysics. As the value of fresh water increases, and as societies become more aware of the long-range problems relative to obtaining adequate supplies of fresh water, the need and support for groundwater geophysics will expand. (See also W70-09392) (Knapp-USGS)
W70-09405

SEISMIC METHODS IN MINING AND GROUNDWATER EXPLORATION,
Geological Survey of Canada, Ottawa (Ontario).
George D. Hobson.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 148-176, 1970. 29 p, 37 fig, 1 tab, 63 ref.

Descriptors: *Seismic studies, *Groundwater, *Surveys, Investigations, Geophysics, Aquifers, Water levels, Data collections, Hydrologic data, Hydrogeology, Instrumentation, Exploration, Subsurface investigations.
Identifiers: Canada, Groundwater prospecting.

Oil prospecting seismic techniques and equipment can be used, with minor adaptation, for problems associated with mineral and groundwater environments. Compact portable seismographs are now available, most of which are used principally in the refraction mode while there are a few that can record reflected events. Most of these portable seismographs can be used with a hammer struck against a steel plate on the ground as a source of energy thus precluding the use of costly drill holes and explosives. Various types of repetitive sources of energy used in oil prospecting could also be used in mineral prospecting. The various portable

seismographs and their special adaptabilities or features, repetitive sources for land and marine seismic programs and some field techniques are presented for comparison and discussion. Some applications of shallow seismic techniques are set forth with a few typical field results from projects designed and conducted towards the search for minerals and water. (See also W70-09392) (Knapp-USGS)
W70-09406

APPLICATION OF RESISTIVITY METHODS IN MINERAL AND GROUNDWATER EXPLORATION PROGRAMS,
Colorado School of Mines, Golden.
George V. Keller.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 51-66, 1970. 16 p, 18 fig, 2 tab, 24 ref.

Descriptors: *Electrical studies, *Electrical conductance, *Geophysics, *Surveys, *Groundwater, Resistivity, Electrical well logging, Water resources development, Data collections, Hydrologic data, Data processing, Hydrogeology, Porosity, Permeability, Mapping, Water levels, Exploration, Subsurface investigations.
Identifiers: Canada, Groundwater prospecting.

The 'direct-current' resistivity methods have been used for about a half century and have reached a certain degree of maturity. In many respects, particularly in design of field equipment and approach to interpretation of field data, little has changed in the past twenty to thirty years. In other respects, including the design of field programs and the evaluation of resistivity measurements in geologically meaningful terms, rapid advances are currently being made. During the past decade, the electrode arrays used in field surveys have changed, and now, one may select an array which is best suited for a specific problem. For example, the Schlumberger array provides the greatest depth of penetration for a given amount of work, while the dipole array provides the greatest safety in working in areas where there is a great deal of culture. Studies of the relationship between resistivity and other rock characteristics, such as porosity, texture, salinity of groundwater and content of ore minerals, have provided a basis for evaluating resistivities once they are measured, as well as a basis for predicting the probable success of resistivity surveys for specific exploration problems. (See also W70-09392) (Knapp-USGS)
W70-09407

THE USE OF GRAVIMETER MEASUREMENTS IN MINING AND GROUNDWATER EXPLORATION,
Geonautics, Inc., Washington, D.C.
W. E. Strange.
French resume. In: Mining and Groundwater Geophysics//1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 46-50, 1970. 5 p, 39 ref.

Descriptors: *Geophysics, *Gravity studies, *Surveys, *Groundwater, *Water resources development, Investigations, Data collections, Hydrologic data, Hydrogeology, Porosity, Density, Cumputers, Data processing, Mapping, Borehole geophysics, Exploration, Subsurface investigations.
Identifiers: Canada, Groundwater prospecting, Borehole gravimeters.

Improvements in the portability, range, calibration, accuracy and drift characteristics of modern land gravimeters provide data of increased accuracy in conjunction with a decrease in time, effort and cost for a survey. The new instruments also make possible the execution of special work such as gravity-gradient surveys, three-dimensional mine surveys and offshore gravity surveys. A more difficult problem has been the development of gravimeters for use on moving platforms. Much progress has been made on gravimeters for shipboard use but airborne systems are still in the experimental stage. The borehole gradiometer offers real promise for providing porosity estimates in groundwater studies and density estimates in mining work. Computerized field data handling permits rapid data plotting and contouring as well as swift and accurate reductions including the terrain correction, and, in the case of moving platform systems, processing of information from other sensors. Computerized data handling can be conveniently grouped in two categories: separation of local and regional anomalies and the fitting of density models to explain the observed gravity field. A number of techniques for resolving these problems are available and many others are still under consideration. (See also W70-09392) (Knapp-USGS)
W70-09408

INTERPRETATION OF GEOELECTRICAL RESISTIVITY MEASUREMENTS FOR SOLVING HYDROGEOLOGICAL PROBLEMS,
Federal Earth Research Inst., Hanover (West Germany).
H. Flathe.
French resume. In: Mining and Groundwater Geophysics/1967, Proceedings of Canadian Centennial Conference at Niagara Falls, Canada, Oct 1967, Canada Geological Survey Economic Geology Report No 26, p 580-597, 1970. 18 p, 24 fig, 23 ref.

Descriptors: *Electrical studies, *Aquifers, *Groundwater, *Surveys, Resistivity, Seismic studies, Porosity, Permeability, Hydrogeology, Data collections, Hydrologic data, Exploration, Subsurface investigations.
Identifiers: Groundwater prospecting.

The interpretation of geoelectrical resistivity measurements for hydrogeological problems is substantially determined by the physical parameter of specific electric resistivity. In the treatment of hydrogeological problems we have to deal exclusively with the ionic conductivity of the soil and this, again, depends on the pore or interstitial volume of the rock, on its water saturation and on the electrolytic content of the groundwater. The dependence of the specific resistivity on the electrolytic content of the pore water renders the geoelectrical resistivity method an effective means for fixing the limit between fresh and salty groundwater. The significance of the geoelectrical resistivity method is that it is capable, used with the seismic method, to subdivide a horizontally stratified aquifer system. Case histories from humid and arid areas illustrate how, be geoelectrical resistivity measurements, hydrogeological problems may be solved using a suitable combination of the presently available methods of interpretation. (See also W70-09392) (Knapp-USGS)
W70-09409

CHAPTER 4: MONITORING THE ENVIRONMENT.
National Academy of Sciences-National Academy of Engineering, Washington, D.C. Environmental Studies Board.

Washington, D.C., National Academy of Sciences - National Academy of Engineering, Jaunuary 1970. p 37-42.

Descriptors: *Monitoring, *Environment, Institutions, Environmental effects, Management, Planning, Administration.
Identifiers: *Environmental monitoring program, *Environmental quality index, Environmental quality.

The environment cannot be effectively managed without knowing what it is or how it behaves. Accordingly an environmental monitoring program is recommended with a high priority. Such a monitoring program must include at least the following: (1) Physical and chemical properties of land, air, and water; (2) Distribution of plants and animals in land, air, and water; (3) Land use, including diversity of purpose; (4) Construction; (5) Noise; (6) Epidemiology of man, animals, and plants; (7) Evidence of environmental stress, such as tranquilizer consumption and a social behavior; and (8) Aesthetic qualities. Also recommended is an overall environmental quality index which would serve as a management tool in developing priorities among environmental programs. Finally it is recommended that federal programs for comprehensive and systematic monitoring of environmental quality be carried out by an environmental monitoring agency. (See also W70-08929) (Davis-Chicago)
W70-09442

COLOR-VELOCITY METHOD IN MEASURING DISCHARGE,
United States Lake Survey, Detroit, Mich.
Ira M. Korkigian, and Thomas E. Ottenbaker.
Available from NTIS as AD-706 874, $3.00 in paper copy, $0.65 in microfiche. Lake Survey Miscellaneous Paper no MP-70-1, Jun 1969. 34 p.

Descriptors: *Flow measurement, *Fluorometry, *Flow rates, Open channel flow.
Identifiers: St. Clair River, Michigan.

This is the first attempt by the U.S. Lake Survey in applying fluorescent dyes for measurement of the discharge in an open channel. The purposes of the tests were: (1) to become familiar with the instrumentation and the use of fluorescent dyes, and (2) to compare the results of the dye method with standard current meter methods. Five tests were run, with three being run simultaneously with standard methods.
W70-09449

RHEOLOGICAL AND ULTIMATE STRENGTH PROPERTIES OF COHESIVE SOILS,
Kentucky Dept. of Highways, Lexington. Div. of Research.
For primary bibliographic entry see Field 08D.
W70-09452

STUDY OF THE USE OF AERIAL AND SATELLITE PHOTOGRAMMETRY FOR SURVEYS IN HYDROLOGY,
National Environmental Satellite Center, Washington, D.C.
Everett H. Ramey.
Available from NTIS as PB-191 735, $3.00 in paper copy, $0.65 in microfiche. ESSA Technical Memorandum, NESCTM-14, Mar 70. 31 p.

Descriptors: *Hydrography, Satellites, *Data collections, *Remote sensing.
Identifiers: Satellite photogrammetry.

The study was undertaken to explore possible applications of photogrammetry in problems of hydrology. The critical factors in the use of satellite photographs are included as part of this study. Also the various physical and economic factors in the use of aerial photogrammetry are analyzed in the measurement of both snow cover and snow depth. It was concluded that the required accuracy can be attained, but sometimes the cost would be prohibitive. The use of aerial photography and other related sensors to some other problems in hydrology are considered. Here it seems that such remote sensing from aircraft offers the hydrologist a feasible means to map some special events where detailed mapping is needed.
W70-09454

7C. Evaluation, Processing and Publication

OPTIMAL RESOURCE ALLOCATION AND SOME TECHNIQUES OF OPTIMIZATION,
Purdue Univ., Lafayette, Ind.

For primary bibliographic entry see Field 05G.
W70-09182

DIGITAL ANALYSIS OF AREAL FLOW IN MULTIAQUIFER GROUNDWATER SYSTEMS: A QUASI THREE-DIMENSIONAL MODEL,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
W70-09197

USE OF TOPOLOGIC INFORMATION IN PROCESSING DATA FOR CHANNEL NETWORKS,
IBM Watson Research Center, Yorktown Heights, N.Y.
I. S. Smart.
Water Resources Research, Vol 6, No 3, p 932-936, June 1970. 5 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Drainage patterns (Geologic), Statistical methods, *Path of pollutants, Geomorphology, *Data processing, Topography, Data collections, Statistics, Stochastic processes, Markov processes, Probability, Digital computers.
Identifiers: Drainage network topology, Topology.

The binary digit representation of channel network topology is proposed as an aid to data handling for channel networks. Examples of its use are drawn from the fields of water pollution control and geomorphology. (Knapp-USGS)
W70-09204

AQUIFER SIMULATION ON SLOW TIME RESISTANCE-CAPACITANCE NETWORKS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-09226

FLOOD PLAIN MAPPING BY THE U. S. GEOLOGICAL SURVEY,
Geological Survey, Champaign, Ill.
For primary bibliographic entry see Field 06F.
W70-09255

A THEORETICAL ANALYSIS AND NUMERICAL SOLUTIONS OF UNSATURATED FLOW IN SOIL,
Gifu Univ. (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 02G.
W70-09305

A LINEARIZATION TECHNIQUE FOR THE STUDY OF INFILTRATION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Plant Industry.
For primary bibliographic entry see Field 02G.
W70-09307

SOLUTIONS OF THE NON-LINEAR DIFFUSION EQUATION WITH A GRAVITY TERM IN HYDROLOGY,
Technion - Israel Inst. of Tech., Haifa; and California Univ., Berkeley.
For primary bibliographic entry see Field 02G.
W70-09308

SOME NUMERICAL METHODS FOR SOLVING PROBLEMS OF NON-STEADY SEEPAGE IN NON-HOMOGENEOUS ANISOTROPIC SOILS,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation (USSR).
For primary bibliographic entry see Field 02G.
W70-09309

APPLICATION OF REGRESSION ANALYSIS IN HYDROLOGY,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
N. Tywoniuk, and K. Wiebe.
Canada Department of Energy, Mines and Resources Inland Waters Branch, Technical Bulletin No 24, 1970. 18 p, 2 fig, 9 ref.

Descriptors: *Statistical methods, *Regression analysis, Correlation analysis, Data processing, Hydrologic data, Statistical models, Mathematical studies.
Identifiers: Canada.

The use of regression analysis as one of the statistical tools in the field of hydrology is explained. Its main applications are in the study of the relationship between two or more hydrologic variables and the investigation of dependence between the successive values of a series of hydrologic data. Hydrologic data rarely, if ever, completely meet the requirements or assumptions on which the regression method is based. Its main difference from correlation analysis should be emphasized: the regression method does not require that the variables be normally distributed as does the correlation method. Graphical and analytical regression analyses are among the most useful statistical tools in hydrology. The use of the digital computer considerably reduces the work of the analytical analysis making it possible to include variables which would otherwise go unnoticed. The analytical analysis must be done with care and with the help of graphical plots, otherwise it is possible to get nonsense correlations or to draw unwarranted inferences from the data. (Knapp-USGS)
W70-09391

08. ENGINEERING WORKS

8A. Structures

OKLAHOMA EX REL PHILLIPS V GUY F ATKINSON CO (INJUNCTION AGAINST DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09071

AN EVALUATION OF THE PROBLEMS OF SANITARY SEWER SYSTEM DESIGN,
Johns Hopkins Univ., Baltimore, Md. Dept of Sanitary Engineering and Water Resources.
John C. Geyer, and John J. Lentz.
Final Report of the Residential Sewerage Research Report of the Federal Housing Administration Technical Studies Program, (1964). 115 p, 24 fig, 25 tab, 7 ref.

Descriptors: *Sewers, *Sanitary engineering, *Hydraulic design, *Municipal wastes, *Maintenance, *Operating costs, Infiltration, Root system, Data collections, Collapse, Pumping plants, Urbanization.
Identifiers: *Sanitary sewers, *Sewer design, *Sewer design problems, *Flow estimates, Sewage pumping stations, Data collection, Residential sewer systems, Sewer stoppages, Engineering design.

Describes the most extensive coordinated investigation into the functioning of sanitary sewers ever conducted, according to the authors. Operational, maintenance, and design problems confronting sewer designers were studied using field data collected in four U. S. communities: Springfield, Missouri; Anaheim, California; Bradenton, Florida; and Baltimore County, Maryland. The extensive four-year data collection program was organized and coordinated by Johns Hopkins personnel. The data was used to study the nature and functioning of sanitary sewerage systems serving residential communities. It was found that fewer sewer blockages result when grades are moderate, and that more blockages occur at the upper terminals of the sewer lines. The distance between manholes appears to have little influence on the costs of relieving stoppages. The maximum manhole spacing is limited by the reach of sewer cleaning equipment. The basic causes of sewer maintenance problems are tree roots, accumulations of debris in the absence of roots, and, in areas having cohesionless soils, cave-ins. Infiltration of groundwater and stormwater was found to be excessive and unpredictable in all systems studied, making the use of estimated domestic flow quantities meaningless for design purposes. Limited data on costs of operating and maintaining sewage pumping stations are reported and evaluated. Many tables, illustrations and charts, useful in sanitary sewer design, are included. (Poertner)
W70-09185

ELECTRONIC COMPUTER PROGRAM FOR HYDRAULIC ANALYSIS OF BOX CULVERTS (BPR PROGRAM HY-3),
Bureau of Public Roads, Washington, D.C.
J. R. Link, R. C. Tennent, and L. J. Harrison.
Available from NTIS as PB-191 356, $3.00 in paper copy, $0.65 in microfiche. Supersedes PB-168 717. 5th Printing, Sep 67. 51 p, 1 fig, 3 tab.

Descriptors: *Roads, *Culverts, *Drainage systems, Drainage programs, Hydraulic design, Hydraulic engineering, Computer programs, Civil engineering, Pipes.
Identifiers: *Box culverts.

This program is used for the hydraulic analysis of box culverts for given hydrological data and site conditions. The program determines the size of culvert which satisfies the hydrological data and site conditions for inlet control and outlet control. The output includes: number of barrels, culvert width, culvert height, headwater and outlet velocities. Outlet control calculations make use of backwater calculations.
W70-09445

8B. Hydraulics

ABOUT THE ROUGHNESS PROBLEM IN PIPES AND TUNNELS,
Technische Hochschule, Munich (West Germany).
P. G. Franke.
13th Congr Int Assn Hydraul Res, Proc Vol 2, p 349-355, Aug-Sept 1969. 7 p, 3 fig, 13 ref.

Descriptors: *Pipes, *Tunnels, Surface properties, *Tunnel hydraulics, *Roughness coefficient, *Roughness (Hydraulic), Energy losses, Sands, Bituminous materials, Hydraulics, Operations, Foreign research, Grain sizes.
Identifiers: *Friction factors, *Pipe linings, Friction coefficient (Hyd), *Resistance coefficients, Germany, *Rugosity.

The effect of variations in surface roughness in pipes and tunnels is demonstrated, and the difference between technical roughness and equivalent sand grain roughness is explained. The cause and effect of alterations in effective roughness of closed conduit linings are variable. Apart from the quality of water and the height of the roughness elements, the texture and pattern are particularly important. Especially remarkable is the ripple-like roughness that is formed by certain quality waters. Compared with the equivalent sand grain roughness of equal height, much larger friction factors result. The simulated sand roughness is to be considered as a parameter for the roughness conditions only; in analogy, the relative roughness is also a parameter. Case histories of various pipe installations in Europe are discussed. (USBR)
W70-09011

ZONE LENGTHS OF AIR EMULSION IN WATER DOWNSTREAM OF THE RING JUMP IN PIPES,
Hydraulic Research Inst., Prague (Czechoslovakia).
K. Haindl.
13th Congr Int Assn. Hydraul Res, Proc Vol 2, p 9-19, Aug-Sept 1969. 11 p, 4 fig, 7 ref.

Descriptors: *Pipes, *Pipe flow, Hydraulic jump, Turbulent flow, Flow, Turbulence, *Air, Hydraulics, Cones, Valves, Water treatment, Energy dissipation, Aeration, *Reaches (Distance), Deaeration, Fluid flow.
Identifiers: *Ring jump, Air-water mixtures.

Basic properties of ring jump in closed conduits are discussed. The hydraulic phenomenon in which the water ring flowing along pipe walls enlarges into a flow through the whole profile is called ring jump. It manifests itself, as does the usual hydraulic jump, by vortices and high turbulence flow, in this case by the formation of characteristic vortices in planes drawn through the pipe axis. Its occurrence is subject to the equality of the flow pressure force downstream of the jump and the dynamic force of the moving ring. The ring jump forces air from the space in front of the jump into the pressure flow following the jump and mixes all fluid components into homogeneous flow. Within the intense turbulent flow following the jump in the air turbulence zone in the liquid and also in the vortices of the jump, both fluid comoponents influence each other very effectively. This phenomenon may be applicable to conditioning and treatment of water, and for dissipation of kinetic energy from dispersion cone valves and the aeration of outflowing water. (USBR)
W70-09022

HYDRAULIC DESIGN FOR CHECK METHOD OF IRRIGATION,
Punjab Agricultural Univ., Hissar (India).
For primary bibliographic entry see Field 03F.
W70-09136

BUOYANT PLUMES AND THERMALS,
Cambridge Univ. (England). Dept. of Applied Mathematics and Theoretical Physics.
For primary bibliographic entry see Field 05B.
W70-09168

TURBULENT DIFFUSION IN A STABLY STRATIFIED SHEAR LAYER,
Colorado State Univ., Fort Collins.
Fazal H. Chaudhry, and Robert N. Meroney.
Technical Report C-0423-5 Sept. 1969. 185 p, 61 fig, 5 tab, 73 ref.

Descriptors: *Diffusion, *Thermal stratification, *Boundary layers, *Tunnels, *Simulation analysis, *Air pollution, Turbulence, Diffusivity, Velocity, Fluid Mechanics, Radioisotopes, Theoretical analysis, Laboratory tests.
Identifiers: *Gaussian effect, *Similarity theory, *Three dimensional analysis, Ground level concentrations, Atmospheric surface layer.

Diffusion of a passive substance released from a continuous point source in a stably stratified shear layer is investigated both theoretically and experimentally. Using Monin-Obukhov's velocity profile and assuming a vertical eddy diffusivity which is a power function of the stability parameter, z/L, the Eulerian turbulent diffusion equation is solved to obtain expressions for vertical and longitudinal velocities of the center of mass of a cloud in the constant stress region. These expressions give physical substance to those suggested by Gifford (1962) and Cermak (1963 as intuitive extensions of Batchelor's Lagrangian similarity theory. A stably stratified shear layer was produced by heating the air and cooling the wind tunnel floor. Detailed observations of the diffusion field, downwind ground and elevated point sources, have been made using Krypton-85 as a tracer. The concentration characteristics obtained from diffusion experiments show excellent agreement with those observed in the atmosphers. The data compares well with the predictions of similarity theory. It appears that the parameters evaluated in the field by Klug (1968) hold also for the wind tunnel data. The data support the assumption of a Gaussian effect of source height, for elevated releases, on the ground level concentration. (Hsieh-Vanderbilt)
W70-09173

OPERATING FORCES ON SECTOR GATES UNDER REVERSE HEADS; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
N. R. Oswalt.
Sponsored by U.S. Army Engineer District, New Orleans. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-70-2, March 1970. 13 p, 6 tab, 8 pl.

Descriptors: *Hydraulic models, *Gates, *Floodgates.
Identifiers: *Sector gates, *Operating forces, Reverse head (Fluid mechanics).

In southern Louisiana several existing sector gate locks have experienced operational difficulties during reverse heads of 1.0 ft or greater. The sector gate would stall at a small opening, resulting in delay at lockage or breakdown in machinery. A 1:20-scale model with one set of gate leaves was constructed to measure forces acting on sector gate during reverse heads, develop feasible modifications for elimination of stall at existing structures, and test a gate of new design for use in future structures. From past experiences and observation of flow in the model, it was considered that head differentials across the members of the gate near the nose of each leaf probably caused a major portion of the load on the gate machinery. Three modifications designed to reduce head differentials across the members near the gate nose were tested; type 2 gave the greatest force reduction for the least prototype change. Use of shorter seal brackets attached to skin plate was also recommended. (Spivey-Waterways Experiment Station)
W70-09177

WAVE ACTION AND BREAKWATER LOCATION, VERMILION HARBOR, OHIO; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
C. W. Brasfeild.
Sponsored by U.S. Army Engineer District, Buffalo. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-70-5, May 1970. 18 p, 6 tab, 4 photo, 6 pl, 7 ref.

Descriptors: *Breakwaters, *Hydraulic models, *Waves (Water), Shore protection.
Identifiers: *Vermilion Harbor, Ohio; Lake Erie.

Model investigation was made to test and develop plans for improvement proposed for reducing wave heights at the harbor entrance and in the outer reaches of Vermilion River channel. The 1:75-scale model, molded in cement mortar, reproduced approximately one-half mile of the Lake Erie shoreline on each side of harbor entrance, about 3600 ft of the river channel, several boat mooring lagoons off the main channel, and sufficient underwater contoured area to permit accurate simulation of storm-wave action. A 52-ft-long wave machine and electrical wave height measuring and recording apparatus were used. It was concluded that an offshore breakwater, approximately 700 ft long, installed perpendicular to entrance channel center line and 200 ft from outer end of the existing east channel pier would provide adequate protection from wave action. (Spivey-Waterways Experiment Station)
W70-09178

SPILLWAY AND OUTLET WORKS, ROWLESBURG DAM, CHEAT RIVER, WEST VIRGINIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
J. H. Ables, and M. B. Boyd.
Sponsored by U.S. Army Engineer District, Pittsburgh. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report H-70-7, June 1970. 22 p, 6 tab, 7 photo, 31 pl.

Descriptors: Concrete dams, *Outlet works, *Spillways, Stilling basins, *Hydraulic models, *Open channel flow, *Sluices.
Identifiers: *Rowlesburg Dam.

Tests were conducted on a 1:20-scale sluice intake model and a 1:60-scale comprehensive model to study hydraulic performance of spillway, to verify adequacy of spillway and sluices for both separate and combined flow operation, to verify and/or to refine the stilling basin design, to study approach and exit channel conditions, to evaluate the effectiveness of the water-quality control tower and sluice in selectively withdrawing water from desired levels, and to investigate pressures in the sluice intake. The stage-discharge curve for combined uncontrolled spillway and sluice flow developed from model test results is in close agreement with computed curves. Capacity of structure is adequate. 12 stilling basin designs were tested, and one recommended over the others. Two schemes for selective withdrawal from top 15 ft of reservoir fell short of desired operating characteristics. (Spivey-Waterways Experiment Station)
W70-09180

TURBULENCE MEASUREMENTS NEAR THE FREE SURFACE OF AN OPEN CHANNEL FLOW,
Illinois Univ., Urbana.
For primary bibliographic entry see Field 02E.
W70-09208

EFFECTS OF EFFLUENT AND INFLUENT SEEPAGE ON THE HYDRODYNAMIC FORCES ACTING ON AN IDEALIZED NONCOHESIVE SEDIMENT PARTICLE,
Utah State Univ., Logan. Dept. of Civil Engineering.
M. V. Panduranga Rao.
Utah State University, PhD Dissertation, Dep of Civil Engineering, 1969. 133 p, 34 fig, 11 tab, 59 ref, 2 append. NSF Research Grant GK-913.

Descriptors: *Erosion, *Open channel flow, *Seepage, *Alluvial channels, *Hydraulic models, Viscosity, Hydrodynamics, Hydrostatic pressure, Flow around objects, Reynolds number, Instrumentation, Flumes, Model studies, Hydraulic similitude.
Identifiers: Hydrodynamic lift.

The effects of effluent and influent seepage on the hydrodynamic forces acting on an idealized noncohesive sediment particle were investigated experimentally. An attempt was made to dynamically simulate the hydrodynamic conditions prevailing near and within an alluvial channel bed by using the shear velocity Reynolds number and the seepage Reynolds number as modeling parameters. In order to achieve dynamic similarity between the laboratory sediment particles (which are 3.75 inches in diameter) and the natural sediment particles (size less than 1 mm) the model fluid used had a dynamic viscosity approximately 200 times greater than that of water. The laboratory flume used had provision for introducing seepage along a 5-foot portion of the 15-ft long bed. A parallel-link straingage dynamometer was designed to simultaneously measure drag and lift forces for different channel flow conditions with and without the effects of effluent or influent seepage. A range of shear velocity Reynolds number of 15 to 140 was covered. (Knapp-USGS)
W70-09410

8C. Hydraulic Machinery

THE NEW BRUNSWICK ELECTRIC POWER COMMISSION SOLID STATE-STATE HVDC ASYNCHRONOUS TIE INSTALLATION,
New Brunswick Electric Power Commission, Fredericton; Canadian General Electric Co. Ltd., Peterborough (Ontario); and General Electric Co., Schenectady, N.Y.
F. H. Ryder, C. M. Stairs, and G. D. Breuer.

Amer Power Conf, (Paper) Chicago, Ill, Apr 1970. 24 p, 6 fig, 7 ref.

Descriptors: Transmission (Electrical), *Direct current, *Converters (Electrical), Rectifiers, Alternating current, Economics, Electric power, Bus (Electrical), *Semiconductors, Electric cables, Reliability, Electronic equipment, Electric insulation, Coordination, Transmission lines.
Identifiers: *Solid-state valves, *Interties, Thyristors, Outages, Interconnected systems, New Brunswick, Canada, System stability (Elect).

Canada's New Brunswick Eel River HVDC Converter Station is the first solid-state hvdc system in the world and is important to connected power systems and future applications of hvdc. The project is in the design phase, with commercial operation scheduled for Oct 1, 1972. Many features of the installation use solid-state valves composed of series and parallel-connected thyristors (silicon-controlled rectifiers) differing from present hvdc systems. The installation will provide a nonsynchronour, 2-directional tie between 2 utility systems with all d-c equipment at one location. Rated at 320 mw, 80 kv dc, the converter station incorporates all the features of an hvdc system with the simplifications of all controls at one location and the absence of a d-c line. The power rating of 320 mw is a significant undertaking of importance to the power systems involved. The installation opens the way to other applications for hvdc transmission exploiting solid-state technology, including configurations of overhead lines and cables, and wider use of controlled transmission links and multiterminal hvdc systems. (USBR)
W70-09012

CATHODIC PROTECTION OF THE BONNEVILLE POWER ADMINISTRATION'S 34.5 KV SAN JUAN ISLANDS CABLE,
Bonneville Power Administration, Portland, Oreg.
A. Stanley Capon.
Nat Assn Corros Eng, 26th Annu Conf, (Paper 10) Philadelphia, Pa, Mar 1970. 5 p, 7 fig, 5 ref, append.

Descriptors: *Cathodic protection, *Electric cables, Corrosion, Tides, *Electric potential, Deterioration, Electric power, Transmission (Electrical), Magnetic fields, Electrodes, Sea water, Anodes, Washington.
Identifiers: San Juan Islands, Wash, *Submarine cables, Corrosion currents, Ground currents, Protective coverings, Bonneville Power Admn.

In 1951, the Bonneville Power Administration installed the first 3-conductor, galvanized armored submarine power cable between Fidalgo, Decatur, and Lopez Islands. Each conductor is 300 mcm and has a capacity of about 20,000 kw. Experience gained during operation of the first cable prompted double armoring of a portion of the second cable installed in 1966. The new cable has 3 conductors, each 500 mcm, and is rated at 34.5 kv with a 35,000-kw capacity. The cable armor and method of cathodic protection for the second cable are discussed. Problems pertaining to the cable operation are reviewed, and an analysis of cable armor potential is given. (USBR)
W70-09013

INTERNAL CATHODIC PROTECTION OF WATER COOLED PLANT,
Corrosion and Welding Engineering Ltd. (Great Britain).
R. A. Lowe, and J. W. L. F. Brand.
Nat Assn. Corros Eng, 26th Annu Conf, (Paper 31) Philadelphia, Pa, Mar 1970. 4 p, 3 fig, 1 tab.

Descriptors: Corrosion, *Corrosion control, Foreign design practices, *Cathodic protection, *Anodes, Titanium, Platinum, Cooling water, Saline water, Sea water, *Heat exchangers, Automatic control, Maintenance, Cast iron, Water cooling.
Identifiers: Great Britain, Condenser tubes.

Internal cathodic protection systems can be designed to cover all requirements for sea water-cooled plants by using a continuous-strip titanium anode platinized on one side. Advantages of the anode include: greatly reduced current density and operating voltage, improved throwing power, lower gross current requirement, reduced current loss to close cathode, and easy cutting and fitting. Installation of an experimental cathodic protection system in a nuclear power station condenser water box is discussed. Saline cooling water flows into one-half of the first water box, through one-half of the tube stack into the second water box, reverses direction to flow through the second half of the first box, and then to discharge. Automatic control of potential is used to compensate for changes in operating conditions from variations in salinity, oxygen content, velocity, temperature, coating efficiency, and surface condition. Special requirements for small boxes and application of cathodic protection to boxes already graphitized are discussed. An effective method for box repair is given, allowing for complete graphite removal and cathodic protection with no fear of losing the box. (USBR)
W70-09014

1969 HVDC STRAY CURRENT TESTS ON UNDERGROUND TELEPHONE CABLES,
Pacific Telephone and Telegraph Co., Pasadena, Calif.; and General Telephone Co. of California, Santa Monica.
H. G. Corbett, and James P. Davey.
Nat Assn. Corros Eng, 26th Annu Conf, (Paper 24) Philadelphia, Pa, Mar 1970. 6 p, 5 fig, 3 tab, 3 ref.

Descriptors: *Corrosion, Corrosion control, *Extra high voltage, Field tests, *Direct current, Electrodes, *Telephones, Polarity, Extra long distance, Instrumentation, Electric potential, Electric currents.
Identifiers: *Ground currents, *Buried cables, Southern California, Pacific Northwest-Southwest Intertie, Corrosion currents, Service life.

The 750-kv d-c Pacific Northwest-Southwest Intertie line, to be completed early in 1970, has been of concern to corrosion engineers. Since 1963, when the power system was first considered, the Pacific Coast telephone companies have been conducting tests in Southern California to determine whether there will be serious corrosion effects on underground telephone cables from the hvdc system. Preliminary tests show that cables quite remote from the hvdc ground electrode as well as those in close proximity may be influenced by the system. The degree of influence may not be predictable because any change in apparent earth resistivity, other stray currents, or change in polarity of the hvdc electrodes could change the environment enough to change the severity. Data collected from many diversified locations during these low current tests indicate that 15- to 20-min intervals of high earth current between the hvdc electrodes will not cause any more generalized type corrosion than normal telluric currents. Cables close to electrodes and cables that connect with remote areas are candidates for surveillance. Existing cables and new cables placed within built-up areas would be expected to have a normal service life. (USBR)
W70-09015

INSULATION LEVELS OF DC FILTER REACTORS AND RESISTORS FOR HVDC POWER TRANSMISSION,
Bonneville Power Administration, Portland, Oreg.
Narain G. Hingorani, and Stig A. Annestrand.
Inst Elec Electron Eng Trans Power App Syst, Vol PAS-89, No 4, p 610-618, Apr 1970. 9 p, 18 fig, 3 ref, disc.

Descriptors: *Extra high voltage, *Direct current, *Filters, Costs, Converters (Electrical), *Lightning arresters, *Electric insulation, *Resistors, Transmission (Electrical), Capacitors, Inverters, Faults (Electrical), *Electric reactors, Bridges (Electric), Transients, Electric potential.
Identifiers: Protection (Electrical), Harmonics, Overvoltage, Spark gaps, Flashover, Switching surges.

Insulation of reactors and resistors in the harmonic filter circuits on the d-c side of an hvdc converter station is discussed. The cost of the reactors and resistors is dependent on insulation levels, and could be a substantial part of the total filter costs if insulation levels are comparable to the insulation level of the d-c bus bars. Providing separate arresters across the reactors and resistors is essential because the d-c line arrester does not provide adequate protection for the components. By diligent use of arresters, the insulation levels and costs of the components can be reduced. Arrester duties are small compared to the capabilities of standard a-c arresters. In fact, the arresters would suppress transients on the d-c bus and would reduce the number of d-c arrester operations and assist the d-c arrester in arc quenching. A method of determining appropriate protective levels is presented. (USBR)
W70-09016

PREDICTION OF RELIABILITY AND AVAILABILITY OF HVDC VALVE AND HVDC TERMINAL,
General Electric Co., Philadelphia, Pa.; and Power Technologies, Inc., Schenectady, N.Y.
Charles R. Heising, and Robert J. Ringlee.
Inst Elec Electron Eng Trans Power App Syst, Vol PAS-89, No 4, p 619-624, Apr 1970. 6 p, 3 fig, 1 tab, 10 ref, disc.

Descriptors: *Extra high voltage, *Direct current, *Converters (Electrical), *Transmission (Electrical), Rectifiers, Reliability, Costs, *Electronic equipment, Design, Failure (Power), Forecasting, Valves, Analysis, Field data.
Identifiers: *High voltage, *Terminal facilities (Elect), Outages, Electric utilities.

A high-voltage direct-current terminal using silicon-controlled rectifiers (SCR's) contains several thousand electronic components. An availability and reliability prediction was made for an hvdc terminal containing SCR's for use in cost-reliability tradeoff decisions in designing the terminal to assure that the hvdc terminal would be designed adequately. This prediction was made using published failure rates for the electronic equipment. Published failure rates and outage duration times were used to such a-c equipment as power transformers and power circuit breakers. Field failure rate data were used for the SCR's. Estimates were used for the time required to replace electronic equipment in order to restore service. The approach used in these analyses is described, and the weakest links are identified and discussed. Silicon controlled rectifiers can be used for hvdc transmission because the system is designed to be fail safe when one or more SCR's fail. (USBR)
W70-09017

TRANSIENT OVERVOLTAGE ON A BIPOLAR HVDC OVERHEAD LINE CAUSED BY DC LINE FAULTS,
Bonneville Power Administration, Portland, Oreg.
Narain G. Hingorani.
Inst Elec Electron Eng Trans Power App Syst, Vol PAS-89, No 4, p 592-610, Apr 1970. 19 p, 31 fig, 15 ref, disc.

Descriptors: *Direct current, *Faults (Electrical), Transients, Costs, Extra high voltage, Capacitors, Digital computers, *Transmission lines, Lightning, Lightning arresters, Bibliographies, Simulation, Filters, Converters (Electrical), Frequency, Resistance, Electrical coronas, Electric insulation.
Identifiers: *Overvoltage, High voltage, *Bipolar transmission lines, Protection (Electrical), Terminal facilities (Elect), Flashover.

Digital programs are used to investigate the overvoltages induced in one pole of a bipolar hvdc overhead line caused by a line-to-ground fault on the

other d-c pole. Various digital tests are performed, paying particular attention to the nature of d-c line termination at the converter stations, including filter circuits and a surge capacitor. The terminal that looks inductive to a wavefront coming from the d-c line is undesirable because it would cause high overvoltages at the terminal of the unfaulted pole. In order to reduce the risk of developing a double-pole outage from a single-pole fault eliminating the surge capacitor is desirable, if a suitable d-c lightning arrester can be designed. Tests are presented in stages to isolate the effects of fault resistance, grid control, and line resistance. Results indicate necessary restraints on the dv-dt line fault detection to avoid operation of this protection in the unfaulted pole. Has 15 references. (USBR)
W70-09018

SWITCHING-SURGE CONSIDERATIONS IN UHV TRANSMISSION LINE DESIGN,
Southern California Edison Co., Los Angeles; and General Electric Co. Pittsfield, Mass.
Fred R. Klumb, and James J. LaForest.
Amer Power Conf, (Paper) Chicago, Ill, Apr 1970. 11 p, 4 fig, 1 tab 12 ref.

Descriptors: *Transmission lines, Research and development, Electrical insulators, Test facilities, Design, Test procedures, Contamination, Electric insulation, Polarity, Bundled conductors, Transmission towers.
Identifiers: *Switching surges, *Ultra high voltage, Flashover, Air gaps, Test results, Lightning surges, Project UHV, *Switching.

Ultra-high-voltage (uhv) research at Project UHV has demonstrated that uhv transmission lines can be constructed to withstand expected switching surges for 1500-kv transmission. Switching-surge studies at Project UHV are the continuation of research undertaken by the industry over many years, now given new life because of 345- to 765-kv transmission systems. Field and transient network analyzer studies showed that airgap spacings required to withstand switching surges were governing because as voltages and spacings were increased, lighning and 60-hz requirements became less important to switching surges for tower air gaps. Recently the trend has been changed where research in the 60-hz strength of contaminated insulator string strength suggests significant nonlinear effects in the uhv range across porcelain supports. Facets of the Project UHV switching-surge research program are reviewed, available uhv results are given, several important findings relative to line design are detailed, and a view of what is needed in this area as the new decade begins is presented. (USBR)
W70-09021

FLOW OF ENTRAINED AIR IN CENTRIFUGAL PUMPS,
Nagoya Univ. (Japan); Toyoda Coll. of Technology (Japan); and Mitsui Ship Building Co., Okayama (Japan).
Hakaru Suehiro, Tsuyoshi Isaji, and Mitsukiyo Murakami.
13th Congr Int Assn. Hydraul Res, Proc Vol 2, p 71-79, Aug-Sept 1969. 9 p, 16 fig, 1 tab, 2 ref.

Descriptors: *Centrifugal pumps, *Air entrainment, Experimental data, Pump testing, *Performance, Impellers, Flow characteristics, Air, *Flow, Losses, Test procedures, Specific weight, Foreign research, *Pumps.
Identifiers: *Air admission, Air bubbles, Japan, Test results, Flow patterns.

Entrained air in centrifugal pumps and its effect on pump performance were investigated. Three types of centrifugal pumps were used during the experiment in which known volumes of air were admitted to the suction side of a pump, and pump performance measured. Results show that pump capacity was reduced as the volume of entrained air increased. When the volume of entrained air on the pump suction side exceeded 15% of the water volume, every pump lost its prime. Entrained air is broken by the pump impeller into nearly uniform diameter bubbles ranging in size from 0.2 to 0.4 mm. Bubble size decreases as pump speed increases; the point of entrance of air bubbles and bubble size have little effect on pump performance. Work necessary to discharge entrained air constitutes the main loss in the pump with air admission. Different-type pumps have nearly the same characteristics for air admission. (USBR)
W70-09023

RAPID REVERSAL OF SAN LUIS PUMPING-GENERATING UNITS,
Bureau of Reclamation, Los Banos, Calif.; and Bureau of Reclamation, Denver, Colo.
R. G. Stroh, B. G. Seitz, and L. W. Lloyd.
Trans (Paper 69 TP 807 - PWR), Inst Elec Electron Eng/Amer Soc Mech Eng Joint Power Generation Conf, Charlotte, N C, Sept 1969. 8 p, 9 fig, 2 tab, 5 ref.

Descriptors: Power system operations, Time, *Pump turbines, Pumping, Hydroelectric plants, Hydroelectric power, Pumping plants, California, Efficiencies, Failure (Power), Pumped storage.
Identifiers: *Rapid reversal, *San Luis Pumping-Generating, Reverse flow, *Reversible turbines, Power system stability, *Pump-generators.

A proposal to reverse the San Luis Pumping-Generating Units from pumping to generating in seconds rather than the design time of 20 min was first made when the plant was nearly operational. An evaluation of the electrical, mechanical, and hydraulic duties on the units and the associated equipment showed that no abnormal stress for the proposed rapid reversal existed. Extensive control modifications were made on one of the units, permitting a series of tests that have verified the feasibility of the rapid reversal mode. Reversals from pumping to generating take from 40 sec at low head to 27 sec near the maximum head. One major advantage of this rapid reversal will be system support in the case of decaying system frequency. Other operational advantages are also seen. The rapid reversal mode may be suitable in part for more conventional pump-storage installations. (USBR)
W70-09034

CALCULATION OF RADIO NOISE LEVEL FOR THE DESIGN OF AC POWER TRANSMISSION LINES,
Central Research Inst. of Electric Power Industry, Tokyo (Japan).
Y. Sawada.
Elec Eng Jap, Vol 89, No 9, p 86-96, 1969. 11 p, 14 fig, 5 tab, 20 ref, append.

Descriptors: *Radio interference, *Transmission lines, Design, Foreign research, Rain, Calculations, Electric fields, *Weather, Bibliographies, Atmospheric precipitation, Conductors, Extra high voltage, *Electrical coronas.
Identifiers: Japan, Electric conductors, Test transmission lines, Test results, Ultra high voltage, Shiobara Test Lines.

Based on experimental studies, and using results of studies relating to radio noise levels on in-service transmission lines to the levels on experimental lines, a method of calculating transmission line radio noise in clear and rainy weather has been developed. The method differs from methods proposed in the past, and is based on statistical analysis of radio noise characteristics. Formulas are presented for calculating the radio noise level caused by conductor corona on transmission lines during fair and rainy weather conditions. The relation between precipitation rate and radio noise level is based on results obtained on the 600-kv Shiobara Test Lines in Japan. The application is intended for design of transmission lines, especially for selection of the conductor size based on a given geometrical arrangement. Has 20 references. (USBR)
W70-09038

IMPULSE DISCHARGE ON CONTAMINATED SURFACE,
Nagasaki Univ. (Japan); Kagoshima Univ. (Japan); and Kyushu Inst. of Tech. (Japan).
H. Matsuo, Y. Yunoki, and T. Oshige.
Elec Eng Jap, Vol 89, No 9, p 26-34, 1969. 9 p, 22 fig, 3 tab, 10 ref.

Descriptors: *Electrical insulators, *Contamination, Foreign research, Electrolytes, Electrodes, Electric arcs, Experimental data, Electrical coronas, Electric potential, Electrical equipment, *Electric insulation, Electric currents.
Identifiers: *Flashover, *Electric discharges, *Suspension insulators, Air gaps, Waveforms, Japan.

Clarifying the flashover mechanism of the contaminated surface in connection with the insulation breakdown of an insulator is important. Discharge on a contaminated surface differs greatly from air-gap discharge; the flashover voltage minimum does not occur in a contaminated surface discharge. Experimental studies of the impulse discharge on the electrolytic surface with the point and plate electrode are presented. Flashover voltage was invariant independently of the wave front duration of the impulse voltage. By using a photomultiplier placed along the discharge path, the partial discharge grows at a faster rate near the needle tip, slows down midway, and speeds up again near the plate. The flashover voltage for the contaminated surface can be raised by placing the barrier electrode between the needle and plate. The barrier electrode blocks the passage of the partial discharge, resulting in an increase of the flashover voltage. Suspension insulators equipped with barrier electrodes exhibit excellent flashover characteristics. (USBR)
W70-09039

OPERATION AND MAINTENANCE OF LARGE HYDRO TURBINES - COLUMBIA AND SNAKE RIVERS,
Corps of Engineers, Walla Walla, Wash.
Edward E. Ashley.
Amer Power Conf, 32nd Annu Meet, Chicago, Ill, Apr 1970. 19 p, 12 fig, 1 tab, 6 ref.

Descriptors: *Maintenance, Kaplan turbines, Francis turbines, Columbia River, Costs, Failure (Mechanics), *Turbines, Bearings, Turbine runners, Hydroelectric plants, Turbine blades, *Hydraulic turbines, Lubrication, *Power operation and maintenance, Corrosion, *Repairing, Bonneville Dam, Contamination, Cavitation, Overloads, *Operation and maintenance.
Identifiers: Wicket gates, Packings, Corps of Engineers, Snake River, McNary Dam, The Dallas Project, Chief Joseph Dam Proj, Wash.

Problems encountered during operation and maintenance of large hydro turbines at the Bonneville, The Dallas, McNary, and Chief Joseph Projects on the Columbia River and at the Ice Harbor Project on the Snake River are described. The problems included the turbine and associated equipment, and involved: (1) grease line failure to the wicket gate lower bearing; (2) failure of the wicket gate combination thrust and guide bearing; (3) replacement of head cover sump pumps; (4) maintenance of turbine runners; (5) turbine failure during rejection tests; (6) failure of blade sevomotor flange gasket; (7) trouble with wicket gate clearances; and (8) rerating generators and the effect on turbines. Each problem is discussed and methods used for solution are given. Turbine data are tabulated for all the plants. (USBR)
W70-09047

RUSSIANS PUSH MAGNETOHYDRODYNAMIC POWER,
Thomas R. Brogan.
Power, p70-71, May 1970, 1 fig, 1 tab.

escriptors: *Generators, *Electric power, Conuctivity, Electrodes.
lentifiers: *Magnetohydrodynamic power, Seed, nvester, Magnetic field.

he Russians are developing a magetohydrodynamic power generating plant which ill operate on natural gas and develop 75 MW, 25 IW of which will be produced by the generator nd the remainder by a bottoming steam plant. In ie generator plant, known as U-25, power is emoved via 48 electrode pairs along the channel, nd there are 48 investers which can be interconected in a multitude of ways to provide operating exibility. The main advantage of this method of ower generation is its efficiency, some 15% above iat of the conventional coal-fired stations. The aparent shortcomings of the Russian plant are its low ombustion pressure and field strength. (Greenanderbilt)
/70-09167

CONTRIBUTION TOWARDS THE REDUCION OF ICE FOG CAUSED BY HUMID TACK GASES AT ALASKAN POWER STAIONS,
lasgow Univ. (Scotland); and Dartmouth Coll., anover, N.H.
or primary bibliographic entry see Field 05G.
/70-09172

PACE HEATING IN URBAN ENVIRONIENTS,
ak Ridge National Lab., Tenn.
. J. Miller.
his study was sponsored by the U. S. Department f Housing and Urban Development under the conact between the Union Carbide Company and the . S. Atomic Energy Commission. Oak Ridge Naonal Laboratory TID Document No. CONF-80810, p 219-237, 1968. 13 fig, 7 tab, 19 ref.

escriptors: *Nuclear powerplants, *Nuclear ener, *Thermal powerplants, *Heating, *Cooling, Air conditioning, *Thermal power, *Nuclear eactors, *Multiple-purpose projects, *Powerlants, *Pollution abatement, *Water pollution ontrol, *Water cooling, *Steam turbines, *Water onservation, *Thermal pollution, *Energy losses, Electric reactors, *Underground powerplants, Vater conservation, Water temperature, Steam, Irbanization, Turbines, Electricity, Air pollution, latural resources, Cost comparisons, Heated ater, Electric power industry.
lentifiers: *Waste heat, *Energy centers, *Utilizaon of waste heat, *Central heating and cooling, Space heating, Air pollution control, Power costs, onservation of energy, Fossil fuel, Heating costs, urbine bleed steam, Back-pressure steam.

eports the preliminary findings of a systems analyis of the usefulness of nuclear energy centers in or ear large cities and the application of energy cenrs to the development patterns and problems of merican cities. It is concluded that in 1980 the eat from a nuclear energy center could be used to eat and air-condition a large portion of a large city t a cost per unit of heat equivalent to that now inurred by district heating in downtown commercial nd high-rise apartment areas. The areas served ould be much larger and they could consume uch less heat per unit of area than those now erved in this country by district-heating systems. leat from back-pressure steam and turbine bleed ould be used rather than heat from prime steam; herfore the waste of heat from the plant generating lectricity would be significantly reduced. Such a ystem would reduce both chemical pollution of he air and thermal pollution of streams. Calculaions indicate that distribution piping systems could e extended to serve larger areas economically, nd that the use of medium or high temperature vater would be more economical than high-presure steam. Investigations of system reliability, time ariation in load, economics, geographical inluences, and accuracy of calculations are recomnended. (Poertner)
W70-09192

USES OF WASTE HEAT,
Oak Ridge National Lab., Tenn.
For primary bibliographic entry see Field 03C.
W70-09193

HOLYOKE WATER POWER CO V AM WRITING PAPER CO (USE OF WATER POWER BEYOND SCOPE OF GRANT).
For primary bibliographic entry see Field 06E.
W70-09475

8D. Soil Mechanics

FOUNDATION SETTLEMENT AND GROUND REACTION CALCULATIONS USING A DIGITAL COMPUTER,
Taylor Woodrow Construction Ltd. southall (England).
K. F. Zbirohowski-Koscia, and D. A. Gunasekera.
Civ Eng Pub Works Rev, Vol 65, No763, p 152-157, Feb 1970. 5 p, 10 fig, 4 ref.

Descriptors: *Foundations, *Settlement (Structural), Stress, *Computer programs, Soil mechanics, Soils, Numerical analysis, Deformation, Stress distribution, Soil properties, Flexible foundations, Calculations, *Soil pressure, Rigid foundations, Footings, Load distribution.
Identifiers: *Computer-aided design, Computer applications, Boussinesq equation, Spread footings, Compressible foundation, Mat foundations.

Three computer programs for calculating settlements and ground reactions under foundations on nonhomogeneous ground are described. The programs are based on 2 simplifying assumptions: (1) ground stress is distributed in accordance with the Boussinesq formula, and (2) Young's modulus of the ground at each level varies linearly between boreholes. The first program calculates settlement at several chosen points. The load causing the settlements is represented by a system of point loads. The second program calculates ground reactions and settlements under one or more rafts. This calculation proceeds in 2 stages for 2 extreme cases. In the first stage, ground reaction is assumed planar and independent of the rigidity of the raft. The optional second stage assumes that the raft is infinitely rigid compared to the ground. Ground reactions are progressively redistributed so that the ground deformation approaches a plane. The procedure is iterative and must be repeated until adequate precision is obtained. Average deformation, bending moments, and shearing forces are calculated for both cases. The third program repeats the operations of the second program but for rafts of finite rigidities. (USBR)
W70-09036

A CRITICAL STUDY OF THE THEORIES CONCERNING UPLIFT IN HYDRAULIC STRUCTURES ON PERVIOUS FOUNDATIONS,
College of Engineering, Madras (India).
V. C. Kulandaiswamy, and T. N. Ramaswamy.
13th Congr Int Assn Hydraul Res, Proc Vol 4, p 311-320, Aug-Sept 1969. 10 p, 5 fig, 10 ref.

Descriptors: *Uplift pressure, *Hydraulic structures, Dams, Pore water pressures, Theory, Hydrostatic pressure, Pore pressure, Seepage, Weirs, Foundations, Pervious soils, Soil mechanics, Percolation, Underseepage, Electric analogs.
Identifiers: Hydraulic uplift, Comparative studies.

Development of various theories concerning uplift under hydraulic structures on pervious foundations is traced. Creep theory and potential theory are reviewed. Uplift pressures calculated for a few weir profiles using methods proposed by Bligh, Lane, Khosla, and Chugaev are compared to pressures obtained using the electrical analogy method. Relative merits of the methods are discussed. Khosla's and Chugaev's methods, based on potential theory, gave satisfactory results. Khosla's method is restricted to cases of very deep foundations; Chugaev's method reduces the problem to a few simple equations and can be applied to foundations of limited and unlimited depths. Chugaev's method is particularly suitable for field application. (USBR)
W70-09044

LATERAL PRESSURES ON RIGID PERMANENT STRUCTURES,
Mueser, Rutledge, Wentworth and Johnston, New York.
James P. Gould.
Amer Soc Civ Eng Spec Conf Lateral Stresses in Ground and Design Earth Retaining Struct, Cornell Univ, Ithaca, N Y, June 1970. 51 p, 16 fig, 1 tab, 39 ref.

Descriptors: *Lateral forces, *Earth pressure, Walls, Movement, Loads (Forces), Locks, *Retaining walls, Docks, Foundations, Anchors, Passive pressures, Horizontal loads, Slope stabilization, Anchored bulkheads, Soil mechanics, Active pressures, Structural analysis, Soil pressure, Strain, Deflection, Bibliographies, Overconsolidation.
Identifiers: *Rigid structures, Slurry trenches, Design practices, At rest pressure, Swelling pressures, Soil-structure interaction.

Factors influencing lateral earth pressures on rigid retaining structures are reviewed, and analysis of walls of 5 categories of deep permanent structures are discussed. The 5 categories are: (1) cantilever retaining walls, (2) walls of U-frame locks and docks, (3) foundation walls of structures, (4) slurry trench concrete walls for foundation construction, and (5) rigid structures for slope stabilzation. Each category is discussed from the standpoint of providing some information to assist designers in the difficult judgments necessary in analyzing walls subjected to lateral earth pressures. Specific conclusions are presented for each category. General conclusions are that as substructures become larger and more complicated, soil-structure interaction becomes more important than the esoteric properties that the soil may potentially possess; and with ordinary U S soil types lacking great sensitivity, lateral earth pressures can be rationalized from a knowledge of construction methods and structural characteristics, and no especially startling or unexpected loadings are likely. Has 39 references. (USBR)
W70-09045

LEAKAGE THROUGH BURIED CHANNELS,
For primary bibliographic entry see Field 04A.
W70-09049

RESEARCH INTO THREE-DIMENSIONAL SEEPAGE IN JOINTED ROCK FOUNDATIONS OF HIGH DAMS.
For primary bibliographic entry see Field 04A.
W70-09050

RHEOLOGICAL AND ULTIMATE STRENGTH PROPERTIES OF COHESIVE SOILS,
Kentucky Dept. of Highways, Lexington. Div. of Research.
Gordon D. Scott.
Available from NTIS as PB-191 368, $3.00 in paper copy, $0.65 in microfiche. Kentucky Highway Dept. Interim Research Report KYHPR 65-38, HPR 1 (4), Part II, Feb 69. 96 p.

Descriptors: *Soil strength, Soil density, *Soil tests, Soil stability, *Roadbanks.
Identifiers: Viscoelasticity.

Results of a laboratory study on strength properties of undisturbed and remolded soils is reported. The purpose of the study was to demonstrate that an accurate failure envelope could be developed by testing a single specimen. Thirty-one undisturbed samples were tested in unconfined compression, consolidation, triaxial, and stress relaxation. Eighty remolded specimens (sixty were kaolin) were tested similarly and, in addition, were subjected to a special series of relaxation-triaxial tests. Stress relaxa-

tion was measured for one hour after straining the 4 in. long specimen 0.01-inch. Triaxial specimens were tested by applying an axial load at the rate of 2 percent per hour. (BPR)
W70-09452

8E. Rock Mechanics and Geology

ON GEOLOGICAL AND TECHNOLOGICAL ASPECTS OF ORIENTED N-SIZE CORE DIAMOND DRILLING,
Newcastle Univ. (Australia); and Broken Hill Proprietary Co. Ltd., Shortland (Australia).
K. H. R. Moelle, and J. D. Young.
Eng Geol, Vol 4, No 1, p 65-72, Jan 1970. 8 p, 1 fig, 11 ref.

Descriptors: Drill holes, *Drilling, *Drilling equipment, Boreholes, Mining, *Core drilling, *Cores, Orientation, Petrofabrics, Coal mines, Mining engineering, Petrographic investigations, Engineering geology, Rock mechanics, Subsurface investigations, Geologic investigations.
Identifiers: *Diamond drilling, *Core recovery, Australia, Foreign products, *Oriented cores.

A device has been developed to obtain oriented N-size diamond drill cores from relatively deep slim holes. The device fits into a standard N-size vertical hole (3-in. dia) and may be operated using standard diamond drilling equipment. The equipment consists of a preset mechanical timer, compass unit with a paper chart recorder, diamond scribers for marking the core, and a core lifter. The procedure for obtaining oriented cores is described. Improvements in design have overcome the problem of straining the core, which has made some cores unfit for petrofabric analysis. Experiences using the device in Australian coal mining and applications to mining geology are discussed. (USBR)
W70-09028

CROSSING THE SIERRA MADRE FAULT ZONE IN THE GLENDORA TUNNEL, SAN GABRIEL MOUNTAINS, CALIFORNIA,
Southern California Metropolitan Water District, Los Angeles.
R. J. Proctor, C. Marshall Payne, and D. C. Kalin.
Eng Geol, Vol 4, No 1, p 5-8, 57-63, Jan 1970. 13 p, 6 fig, 1 tab, 9 ref.

Descriptors: *Tunnels, *Engineering geology, Geologic investigations, *Faults (Geology), Subsurface investigations, Geologic mapping, Field investigations, Earthquakes, Exploration, Alinements, Landslides, Rock properties.
Identifiers: Glendora Tunnel, Calif, Geologic maps, Geologic profiles.

An excellent opportunity to observe and study a major fault zone was provided in 1966 during construction of the 6.2-mi Glendora Tunnel in California. The Sierra Madre fault zone extends for 55 mi along the steep front of the San Gabriel Mountains. As mapped in the tunnel, the fault zone has an apparent thickness of 520 ft. Within the fault zone are oil-stained brecciated Puente shale, and slivers of Precambrian gneiss and Cretaceous granite that have been thrust at least 700 ft over quaternary terrace deposits. A puzzling situation was encountered in the east portal area where drill holes showed terrace gravels 370 ft beneath apparent basement rocks. This feature was attributed to a thrust fault. Geologic investigations proved that a longer tunnel route would cost several million dollars less to build because of poor rock conditions along a shorter route. Tunnel construction was not adversely affected by the fault materials encountered, but was affected by bentonite shale adjacent to the fault zone. (USBR)
W70-09031

8F. Concrete

CONTROL AND REPAIR OF CRACKS IN CONCRETE DAMS,
Bureau of Reclamation, Denver, Colo.
B. P. Bellport.
Int. Comm. on Large Dams, 9th Congress (Paper) Q.39-R.12 Montreal, Can, p 199-217, June 1970. 19 p, 1 fig.

Descriptors: *Cracking, *Cracks, *Repairing, Concrete control, Mixes, Concrete mixes, *Concrete dams, Concrete placing, Control, Contraction joints, Construction joints, Expansion joints, Mass concrete, Curing, Precooling, *Temperature control, Shrinkage, Expansion, Grouting, Cement grouting, Heat of hydration, Chemical grouting, Concrete technology.
Identifiers: *Crack control, Control joints, *Construction control, Cooling systems, Volume change, Cement hydration, Epoxy mortar.

Causes of cracking in concrete dams, control methods used by the Bureau of Reclamation to control and minimize cracking, and measures used to repair cracks are discussed. Most cracking in mass concrete occurs because of stresses caused by restraint against volumetric changes including temperature change, drying shrinkage, and autogenous shrinkage. Primary control methods are mix design, temperature control, and use of contraction, expansion, and construction joints. Because of the heat generated by hydration of the cement, the concrete mix selected one should provide the required strength and durability with the lowest cement content. Expansion and contraction joints are used to accommodate volumetric changes. Construction joints are used to facilitate construction and to reduce cracking tendencies. Temperature control measures used are precooling concrete ingredients, postcooling by means of embedded pipe systems, and restricting the time or season of concrete placement. Pressure injection of portland cement grout is the most economical method of repairing cracks. Epoxy grouts stop leaks and can restore the structural strength of concrete, but cracks must be dry for effective bonding. Chemical grouts have been used to seal small cracks. (USBR)
W70-09019

A REVIEW OF STRESS-STRAIN RELATIONSHIPS FOR CONCRETE,
Northern Arizona Univ., Flagstaff.
Sandor Popovics.
J Amer Concr Inst, Proc Vol 67, No 3, p 243-248, Mar 1970. 6 p, 2 fig, 2 tab, 35 ref, append.

Descriptors: *Concretes, *Concrete technology, Concrete testing, Axial loads, Axial stress, Compressive strength, *Deformation, Strain, Stress, Flexural strength, Elasticity modulus, Reviews, Bibliographies, *Stress-strain curves, Reinforced concrete, Strength of materials, Cracking.
Identifiers: *Concrete properties, Compressive stress, Formulas, Crack propagation.

A state-of-the-art survey is presented to provide an organized summary, analysis, and evaluation of knowledge on the instantaneous axial deformation of concrete under load. The shape of the stress-strain curve and the numerical approximation of the stress-strain diagram are discussed. The instantaneous deformation of concrete under load is influenced by testing conditions and composition of the concrete. The deformation mechanism is explained qualitatively by the theory of internal crack propagation; under short-time loading, the stress-strain curve deviates from the straight line mainly because of progressive internal cracking. The theory of internal cracking can only provide a qualitative description, and empirical formulas are used for numerical approximations. The limits of validity and degree of approximation for empirical formulas are given. Empirical formulas are also available for estimating unit strain and secant modulus of elasticity at the ultimate compressive strength. Has 35 references. (USBR)
W70-09032

CONSERVATION OF CRAFT SKILLS IN DESIGN,
Bureau of Reclamation, Denver, Colo.
C. F. Palmetier.
Annu Meet Amer Concr Inst, Chicago, Ill, Mar-Apr 1969. 12 p, 4 fig.

Descriptors: Construction, *Crafts, Concretes, *Labor, *Construction costs, Concrete placing, *Concrete construction, Concrete mixes, Steel, *Designers, Concrete plants, Formwork (Construction), Reinforcing steel, Costs, Cleaning, Optimum use, Optimization, *Structural design, Systems analysis, Architecture, *Architects.
Identifiers: *Building design, Design improvements, Spacing, Ready-mix concrete, Form removal, Systems engineering.

For several years the construction industry has experienced change in basic concepts. This change is the substitution of machine power for human power whenever possible. The principal reason for the change is that today's highly skilled workmen are used most economically when their skills and not their muscles are exploited. While the use of available skills is basically the construction contractor's problem, the design engineer has the responsibility to give the contractor the opportunity for optimum use of the skills and power of his craftsmen. For example, with construction contractors proposing unit prices for concrete of $200 and more, the designer must recognize that the cheapest components of structural concrete are cement and aggregate. Costs arise from wasteful use of highly skilled workmen in fabricating and setting intricate forms and unnecessary requirements for placing concrete in confined and congested forms. Perhaps the highly publicized systems approach to design should be expanded or complemented by a designer's systems approach to the efficient use of on-site labor. (USBR)
W70-09033

DETAILING BY COMPUTER,
Zinn (W.V.) and Association (Great Britain).
W. V. Zinn, and L. Rosten.
Civ Eng Pub Works Rev, Vol 65, No 763, p 142-145, Feb 1970. 4 p, 6 fig, 2 ref, 2 append.

Descriptors: *Continuous beams, *Concrete structures, Plates, Computer programs, Beams (Structural), Reinforced concrete, Computers, Structural design, *Reinforcing steel, *Structural members, Calculations, Design tools, Slabs.
Identifiers: *Computer-aided design, *Design practices, Computer applications, Concrete slabs.

A method using a computer to design and detail reinforced concrete continuous beams, plates, and slabs is described. The output is in tabular form to be used directly on site in conjunction with standardized fixing diagrams. The system has been designed to limit office drawing effort to the production of outlines of the structural concrete and to allocate to the computer the task of providing a full set of calculations and detailing instructions that will replace traditional reinforcement detail drawings. This system and further developments will form eventually the basis of a universal detailing process in which the productivity of the office drawing staff and site labor will be increased greatly. The work described is in the pioneer stage, but sufficient experience has been gained to show that the system is practicable and will become more valuable when a greater degree of rationalization is developed in architectural planning. (USBR)
W70-09035

8G. Materials

FLY ASH UTILIZATION CLIMBING STEADILY.

Environ Sci Technol, Vol 4, No 3, p 187-189, Mar 1970. 3 p, 3 fig.

Descriptors: *Fly ash, Coals, Thermal powerplants, *Byproducts, *Solid wastes, Lightweight aggregates, Pozzolans, *Waste disposal, Research and development, Cements, Bricks, Concrete technology, Concretes, Masonry.
Identifiers: Concrete blocks, Pollution control, Reuse.

Most pollution control programs eventually evolve into an ultimate disposal program--getting rid of waste material having little or no economic value. For the electric utility industry, the ultimate disposal problem involves mountains of ash residue that accumulate at coal burning power stations. Fortunately, 17% of the fly ash is recovered for byproduct reuse, and the rate of utilization is rising. Present uses include: pozzolan in concrete, raw material for sintered lightweight aggregate, filler for asphalt, soil stabilization, and hydrated lime-fly ash compounds as base courses for roads. Promising new applications are raw material for cement manufacture, and manufacture of face brick. Fly ash brick is fully competitive with conventional clay brick in strength, performance, appearance, and price, and is 15% lighter. A fly ash processing plant is being built at Hamilton, Ontario, to process the entire 450-tpd fly ash output from Ontario Hydro's Lakeview coal burning power station. The processing plant will produce a uniform, graded product of consistent specifications. About 60% of the ash will be used for sintered aggregate, 15% will be used for pozzolan, and the remainder will be an iron-rich concentrate for steel and other industrial uses. (USBR)
W70-09040

8H. Rapid Excavation

COMPLEX EQUIPMENT FOR SINKING AND DRILLING OF VERTICAL SHAFTS,
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
N. A. Malevich.
Available from NTIS as TT-68-50609, $3.00 in paper copy, $0.65 in microfiche. Trans. of Kompleksy Oborvdovaniya Dlya Prokhodki i Bureniya Vertikal'nikh Stvolov. Clearinghouse Translation TT68-50609, 1969. 383 p. NSF-C466.

Descriptors: *Core drilling, *Drilling equipment, *Shafts (Excavation).
Identifiers: Vertical shafts, Shaft boring.

The designs, bases underlying the theory and calculation, results of experimental studies of Soviet and foreign complex assemblies of equipment and machines meant for sinking and boring shafts have been examined in the book. The book also discusses the technological schemes and technoeconomic indices of mechanized sinking of shafts, generalizes the experience gained by application and results of field trials of complex assemblies of sinking and boring equipment, indicates the future course of development of complex mechanization of work on installation of vertical shafts.
W70-09447

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

RESEARCH ON WATER QUALITY,
California Univ., Davis.
Ray Coppock.
California University Water Resources Center Report No 19, July 1970. 36 p.

Descriptors: *Water quality, *Research facilities, *Projects, *Universities, *California, Education, Laboratories, Model studies, Water Resources Research Act.
Identifiers: University of California.

A brief summary is given, as of mid-1970, of University of California research involving water quality. Preliminary or final results, or at least progress reports, are available for all UC research projects on water quality that have continued for more than a few months. They may be found in technical or semi-technical journals, in University publications, in reports of research units such as the Water Resources Center and the Sanitary Engineering Research Laboratory, or in reports to funding agencies. Scientific projects are described under five headings: measuring and monitoring water quality; biostimulation and other ecological aspects; water quality control and management; sewage and wastewater treatment; and drainage and groundwater quality. (Knapp-USGS)
W70-09348

NATIONAL INSTITUTE OF ECOLOGY: AN INQUIRY, VOLUMES 1 AND 2.
Ecological Society of America, Durham, N.C., and Peat, Marwick, Mitchell and Co.
For primary bibliographic entry see Field 06F.
W70-09366

CHAPTER 3: EDUCATION AND THE ENVIRONMENT.
National Academy of Sciences-National Academy of Engineering, Washington, D.C. Environmental Studies Board.

In: Institutions for Effective Management of the Environment, Washington, D.C. National Academy of Sciences - National Academy of Engineering, January 1970, p 29-36.

Descriptors: *Environment, *Education, Social needs, Universities, Colleges, Management, Planning.
Identifiers: *Environmental coalition, Multidisciplinary programs, Public information.

Successful efforts to conserve our national resources and manage the environment more effectively will depend in large measure on our ability to train people to understand and to cope with the related complex technical and social problems, as well as to develop and implement programs for the distribution of information on a broad scale. Several suggestions are forwarded. First, it recommended that the National Science Foundation undertake to develop and sponsor a Junior Environmental Education Program at secondary school level designed to involve teenage youngsters with the whole range of environmental problems. Second, to facilitate environmental science in the universities, two approaches are suggested: (1) Creation of multidisciplinary programs of environmental affairs within existing universities, to be funded in part by federal grants; and (2) Establishment of an experimental problem-oriented graduate school to be supported in part by a proposed Environmental Coalition. Third, methods are suggested which can aid in the general education of the public. Finally, the establishment of an Environmental Coalition is suggested. This organization would coordinate and achieve support for all relevant publicly instigated programs and activities. (See also W70-08929) (Davis-Chicago)
W70-09441

9C. Research Facilities

REPORT OF WATER RESOURCES RESEARCH, JULY 1, 1968 - JUNE 30, 1969.
Geological Survey, Washington, D.C. Water Resources Div.
U S Geological Survey 7th Annual Report on Water Resources Research, January 1970. 387 p, 16 fig.

Descriptors: *Projects, *Water resources development, Research and development, Research facilities, International Hydrological Decade, Federal government, Tracers, Hydrology, Tracking techniques, Streamflow, Groundwater movement, Estuaries, Water quality, Hydrologic cycle, Planning, Water management (Applied), Data collections.
Identifiers: *U S Geological Survey, *Water resources research.

This, the seventh annual report on water resources research conducted by the Water Division, U. S. Geological Survey, presents information on the status of the 'core' research program of the Division. Much of the program is basic research aimed at developing an understanding of the workings of particular parts of the hydrologic cycle. Another large part of the activity is in water quality management and protection, in which much of the research deals with movement of radioactive material in the water cycle. The third important field is in new methods of collecting, analyzing, and interpreting hydrologic data. Some project activities are associated with the International Hydrological Decade program (IHD). This report is intended primarily for use by the Geological Survey and is distributed only to members of the Survey staff, advisory committees, and others with special interest in development of water resources research. (Lang-USGS)
W70-09389

9D. Grants, Contracts, and Research Act Allotments

RESEARCH ON WATER QUALITY,
California Univ., Davis.
For primary bibliographic entry see Field 09A.
W70-09348

REPORT OF WATER RESOURCES RESEARCH, JULY 1, 1968 - JUNE 30, 1969.
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 09C.
W70-09389

10. SCIENTIFIC AND TECHNICAL INFORMATION

ACOUSTIC SUBBOTTOM PROFILING SYSTEMS, A STATE-OF-THE-ART SURVEY,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 02A.
W70-09176

FLOOD DAMAGE PREVENTION.
Tennessee Valley Authority, Knoxville.

Tennessee Valley Authority Indexed Bibliography, 6th Edition, July 1969. 43 p, 1 fig, 407 ref, index.

Descriptors: *Bibliographies, *Flood protection, *Non-structural alternatives, *Flood plain zoning, Flood plain insurance, Flood control, Warning systems, Water law, Regulation, Legislation, Zoning.
Identifiers: Flood damage prevention (Bibliography).

A bibliography and index are presented of recent literature on both structural and nonstructural methods of flood damage prevention and control. The majority of the entries emphasize flood damage prevention and flood plain regulation, with only a few items on flood control. Most of the publications cited are available on inter-library loan from the TVA Technical Library, Knoxville, Tenn. (Knapp-USGS)

W70-09364

HYDROLOGICAL BIBLIOGRAPHY.

Bulletin International Association of Scientific Hydrology, Vol 15, No 2, p 121-134, June 1970. 14 p.

Descriptors: *Bibliographies, *Hydrology, *Water resources, International Hydrological Decade.

A short bibliography of general hydrological paper categorized by country or international organiza tion and published in 1969-1970, is presented Some of the books and longer papers are reviewed (Knapp-USGS)
W70-09376

SUBJECT INDEX

ABSORPTION
ABSORPTION AND INFILTRATION IN TWO- AND THREE-DIMENSIONAL SYSTEMS,
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Arkansas Water Resources Research Center	W70-09344	1
C. Other		
Herbert G. Poertner - Engineering Aspects of Urban Water Resources	W70-09185--09193	9
Corps of Engineers	W70-09176--09180	5
Office of Saline Water	W70-09150	1
Environmental Technical Applications Center	W70-09456	1
Stanford University	W70-09181	1

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5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 3, NUMBER 23
DECEMBER 1, 1970

W70-09511 -- W70-10033

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 23
DECEMBER 1, 1970

W70-09511 -- W70-10033

of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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2. WATER CYCLE

A. General

CALE EFFECTS IN THE PHYSICAL MODEL-NG OF SURFACE RUNOFF,
lassachusetts Inst. of Tech., Cambridge. Dept. of ivil Engineering.
ictor M. Graveto, and Peter S. Eagleson.
lassachusetts Institute of Technology, ydrodynamics Laboratory Report No 120, ebruary 1970. 328 p, 115 fig, 29 tab, 48 ref, ap-end.

escriptors: *Model studies, *Rainfall-runoff rela-onships, *Hydraulic models, *Hydraulic militude, Analytical techniques, Prototype tests, oughness (Hydraulic), Viscosity, Gravity, Wetta-ility, Surface tension, Computer programs.
lentifiers: Model scale-effects, Kinematic wave heory.

he feasibility of scale modeling of the rainfall-sur-ace runoff process was investigated using a plane, npermeable model and an analytical prototype. he dynamic similarity criteria of previous in-estigators were examined and a new similarity arameter describing the influence of surface ten-ion and surface wettability is introduced. The con-rollable similarity parameters were varied in a ystematic way to evaluate scale effects through a omparison of the model and prototype hydro-raphs in dimensionless form. Surface tension ef-ects were studied using materials of different vettability and by coating the surface of the vatershed with wetting agent solutions. Surface oughness effects were studied using smooth and androughened surfaces. It is possible to select nodel materials and operating conditions such that mall scale models can be used to study overland low with acceptable accuracy. (Knapp-USGS)
W70-09538

CHANGING CLIMATE,
Rand Corp., Santa Monica, Calif.
I. O. Fletcher.
Rand Corporation, Paper P-3933, September 1968. 27 p, 60 ref.

Descriptors: *Climates, *Air circulation, *Precipitation (Atmospheric), *Air temperature, Ice, Water temperature, Rainfall, Fishing, Humidity, Arctic, Winds, Heat transfer, Smog, Weather data, Model studies, Solar radiation, Carbon dioxide, Cloud cover, Turbidity, Evaporation, Cloud seeding, Mathematical models, Heat budget.

The fact that the global climate is changing is illustrated by the northward displacement of the ice boundary during the first three decades of this century. Both the general vigor of the global atmospheric circulation and the variations of sea surface temperatures in response to changing atmospheric circulation are connecting factors that make possible a rational description of global climate. Other variations that cause climate differences involve changes in the zone of cold water at the equator, the extent of ice on the ocean, the degree of atmospheric dirtiness, and the rotation rate of the earth on its axis. Man is inadvertently influencing global climate by his increased CO2 production causing global warming called the 'greenhouse effect'. A 10% change in CO2 can be compensated by a 3% change in water vapor or a 1% change in mean cloudiness. Recent global cooling shows that this has already occurred. Other man-made climatic influences include smog, aircraft exhaust, and ship fuel releases. Purposeful influencing of global climate has already been achieved on a small scale; however, today's advanced technology allows for much greater achievements as the Soviet Union currently emphasizes. (Osborne-Vanderbilt)
W70-09599

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS: PART 2 - THE BROSNA CATCHMENT AT FERBANE,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 06A.
W70-09698

A LINEAR DISTRIBUTED MODEL OF CATCHMENT RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
S. Bravo, A. Carlos, Brendan M. Harley, Frank E. Perkins, and Peter S. Eagleson.
Available from the NTIS as PB-194 289, $3.00 in paper copy, $0.65 in microfiche. Massachusetts Institute of Technology Hydrodynamics Laboratory Report No 123, June 1970. 147 p, 40 fig, 4 tab, 18 ref, 5 append. OWRR Project C-1069, Grant No 14-01-0001-1576.

Descriptors: *Mathematical models, *Rainfall-runoff relationships, *Systems analysis, Open channel flow, Unsteady flow, Linear programming, Routing, Unit hydrographs, Computer programs, Input-output analysis, Simulation analysis, Synthetic hydrology.
Identifiers: Kinematic wave models.

A distributed linear model of direct catchment runoff simulates complex drainage areas by a network of overland flow and streamflow elements in which the one-dimensional equations for unsteady flow in a channel are assumed to govern. Solutions of these equations for suitable boundary conditions are obtained in the form of unit impulse response functions. Based on linear systems theory, any output may be estimated by performing the convolution operation between these impulse response functions and given inflows. The linear model was introduced into the M.I.T. Catchment Model as an alternative to the existing kinematic model. Results obtained with the linear model were compared with results using some non-linear solutions. (Knapp-USGS)
W70-09831

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).

Monica Krippner, Editor. Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, 1967. 740 p.

Descriptors: *Conferences, *Radioactivity techniques, *Tracers, *Tracking techniques, *Radioactive dating, Hydrology, Hydrogeology, Surface waters, Groundwater, Groundwater movement, Streamflow, Reservoirs, Seepage, Stable isotopes, Radioisotopes.
Identifiers: Isotope techniques (Hydrology).

Proceedings of a Symposium on isotopes techniques in hydrology, organized by the IAEA in co-operation with the International Union of Geodesy and Geophysics and held in Vienna, November 14-18, 1966 is presented. The meeting was attended by 167 participants from 36 countries and 7 international organizations. The topics discussed include hydrometeorology, streamflow measurements (7 papers); sediment studies (10 papers); geochronology and environmental studies (10 papers); aquifer characteristics (5 papers); unsaturated zone, seepage, tracer technology (6 papers); surface water, limnology, glaciology (3 papers). Each paper is in its original language (30 English, 9 French and 2 Russian) and is preceded by an abstract in English and one in the original language if this is not English. Discussions are in English. (See also W70-09869 thru W70-09887). (Knapp-USGS)
W70-09868

ISOTOPES IN HYDROMETEOROLOGY,
Stockholm Univ. (Sweden). International Meteorological Inst.
For primary bibliographic entry see Field 07B.
W70-09869

HYDROGEN ISOTOPES IN HYDROLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik.
For primary bibliographic entry see Field 07B.
W70-09870

MODIFICATION OF THE ISOTOPIC COMPOSITION OF RAINWATER BY PROCESSES WHICH OCCUR BEFORE GROUNDWATER RECHARGE,
Weizmann Inst. of Science, Rehovoth, (Israel).
For primary bibliographic entry see Field 02K.
W70-09871

RAINOUT CHARACTERISTICS FOR HYDROLOGICAL STUDIES,
Illinois State Water Survey, Urbana.
G. E. Stout, and F. A. Huff.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/6, p 61-72, 1967. 12 p, 4 fig, 5 tab, 10 ref.

Descriptors: *Fallout, *Rainfall, *Tracers, *Strorms, *Tracking techniques, Data collections, Sampling, Radioisotopes.
Identifiers: Rainout.

During a 4-yr period extensive areal and time sampling was performed of the radioactivity in rainwater in central United States of America. Many surface observations and some airborne water collections were made. It is evident from the data that great variations in rainout are likely during convective storm periods and that those engaged in atmospheric tracer studies must exercise extreme care in the interpretation of observational data because of the natural variability in such storms. Analyses of spatial variability showed a trend for the relative variability of radioactive rainout to: (1) exceed the storm rainfall variability, (2) decrease with increasing rainfall volume and storm duration, and (3) increase with increasing network size. Point representativeness indicating an average error of 20-25% is introduced when a single observation is assumed to represent the mean rainout over areas of 10-12 square miles. The rainout on 26 May, 1965 after the Chinese bomb test is used illustrate the distribution of rainout in time and space over a small network of five recording air-and water-sampling sites in an area of 36 square miles. Airborne observations are also discussed. A classification of the types of time distributions of rainout is proposed, based upon a large sample of observational data. (See also W70-09868) (Knapp-USGS)
W70-09872

ESTIMATING THE TRITIUM INPUT TO GROUNDWATER FROM WINE SAMPLES: GROUNDWATER AND DIRECT RUN-OFF CONTRIBUTION TO CENTRAL EUROPEAN SUFACE WATERS,
Heidelberg Univ. (West Germany). Physikalis ches Institut.
For primary bibliographic entry see Field 02F.
W70-09873

APPLICATION OF RADIOTRACER METHODS IN STREAMFLOW MEASUREMENTS,
For primary bibliographic entry see Field 02E.
W70-09874

USE OF RADIOISOTOPES IN SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09875

RADIOISOTOPE TECHNIQUES FOR DETERMING SILT MOVEMENT FROM SPOIL GROUNDS IN THE FIRTH OF FORTH,
Atomic Energy Research Establishment, Wantage (England). Research Lab.
For primary bibliographic entry see Field 02J.
W70-09876

QUANTITATIVE MEASUREMENT OF MARITIME SEDIMENT MOVEMENT USING RADIOACTIVE TRACERS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 02L.
W70-09877

RADIOISOTOPE TECHNIQUES DEVELOPED IN WATER-POLLUTION STUDIES,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05A.
W70-09878

PERFORMANCE OF NUCLEAR-SEDIMENT CONCENTRATION GAUGES,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 07B.
W70-09879

SURFACE LABELLING OF SAND WITH Cr-51 BY THERMAL DECOMPOSITION OF AMMONIUM DICHROMATE Cr-51,
Australian Atomic Energy Commission, Sutherland (Australia).
For primary bibliographic entry see Field 02J.
W70-09880

SURFACE DEPOSITION OF RADIOISOTOPES ON SAND AND SILTS (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09881

INVESTIGATION INTO THE MOVEMENT OF FLUVIAL BED-LOAD WITH RADIOISOTOPES,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02J.
W70-09882

A CONTRIBUTION TO THE KINETIC THEORY OF BED-MATERIAL DISCHARGE,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 02J.
W70-09883

EROSION BY RAIN IN THE WESTERN CONGO (FRENCH),
Universite Lovanium de Kinshasa (Congo).
For primary bibliographic entry see Field 02J.
W70-09884

DATING OF GROUNDWATER WITH TRITIUM AND C14,
Heidelberg Univ. (West Germany). Physikalisches Institut
For primary bibliographic entry see Field 02F.
W70-09885

MODEL EXPERIMENTS FOR C-14 WATER-AGE DETERMINATIONS,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 02F.
W70-09886

SURFACE-WATER INFILTRATION AND GROUNDWATER MOVEMENT IN ARID ZONES OF VENEZUELA,
Instituto Venezolano de Investigaciones Cientificas, Caracas.
For primary bibliographic entry see Field 02F.
W70-09887

2B. Precipitation

ISOTOPES IN HYDROMETEOROLOGY,
Stockholm Univ. (Sweden). International Meteorological Inst.
For primary bibliographic entry see Field 07B.
W70-09869

HYDROGEN ISOTOPES IN HYDROLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik.
For primary bibliographic entry see Field 07B.
W70-09870

MODIFICATION OF THE ISOTOPIC COMPOSITION OF RAINWATER BY PROCESSES WHICH OCCUR BEFORE GROUNDWATER RECHARGE,
Weizmann Inst. of Science, Rehovoth, (Israel).
For primary bibliographic entry see Field 02K.
W70-09871

RAINOUT CHARACTERISTICS FOR HYDROLOGICAL STUDIES,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02A.
W70-09872

WEATHER MODIFICATION POTENTIAL FOR WATER SUPPLY IN THE COLORADO RIVER,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
W70-09920

ARIZONA WEATHER MODIFICATION RESEARCH PROGRAM,
Meteorology Research, Inc., Altadena, Calif.
For primary bibliographic entry see Field 03B.
W70-09927

RAINFALL RELIABILITY,
Sheffield Univ. (England). Dept. of Geography.
S. Gregory.
In Environment and Land Use in Africa, Thomas, M.F. and Whittington, G. W. (eds) Chapter 4, p 57-82, Methuen, London, 1969. 7 fig, 4 tab, 34 ref.

Descriptors: *Rainfall, *Statistical methods, *Variability, Tropical regions, Semiarid climates, Climatic data, Climatic zones.
Identifiers: *Africa, *Agricultural planning, *Climate prediction.

Various aspects of tropical African rainfall variability measurements and analyses are examined. A general relationship between mean rainfall and variance is supported but not completely confirmed by available data. It is felt that rainfall variability is best expressed in terms of a linear equation between mean and standard deviation rather than as a percentage relationship because absolute terms have greater relevance to potential agricultural needs. Higher rainfall variability in arid areas is at best a generalization with many exceptions. Rainfall data for these areas is often markedly skewed rather than normally distributed. The general concept of higher variability of tropical rainfall relative to temperate rainfall is not supported by the data. Many parts of west Africa have no higher rainfall variability than England. Annual and even monthly mean rainfall data do not provide adequate information for agricultural planning. Rainfall probability studies are urged for areas where rainfall amount is normally distributed and adequate dates are available. Appropriate statistical techniques are discussed. (Casey-Arizona)
W70-09961

2C. Snow, Ice, and Frost

CURRENT TRENDS IN GLACIOLOGY,
Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie.
L. A. Lliboutry.
Earth-Science Reviews, Vol 6, No 3, p 141-167, June 1970. 27 p, 3 fig, 1 tab, 138 ref.

Descriptors: *Glaciers, *Glaciation, Cryology, Geomorphology, Scour, Regimen, Ablation, Ice, Melting, Movement, Rheology, Snowpacks, Climatology, Erosion, Temperature.
Identifiers: *Glaciology.

Glaciology has become a broad interdisciplinary science. Major contributions to glaciology during the last five years are reviewed (131 references are given) and prognoses are made concerning lines of future research. The subjects are grouped under the following headings: (1) Field techniques; (2) Geochemistry and mass balance of polar ice caps; (3) Sliding of temperate glaciers and related problems; (4) Temperature profiles and past history of ice caps; and (5) Glacier erosion and bottom drift. (Knapp-USGS)
W70-09533

RELATION BETWEEN EVAPORATION AND SOIL HYDROCONSTANTS,
Ceskoslovenska Akademie Ved, Bratislava. Inst. of Hydrology and Hydraulics.
For primary bibliographic entry see Field 02G.
W70-09576

ELECTRICAL CHARGES ON SNOW PARTICLES,
Washington Univ., Seattle. Dept. of Atmospheric Sciences.
D. A. Burrows, and P. V. Hobbs.
Journal of Geophysical Research, Vol 75, No 24, p 4499-4505, August 20, 1970. 7 p, 7 fig, 1 tab, 15 ref. NSF Grant GA-780.

Descriptors: *Snow, *Precipitation (Atmospheric), *Cloud physics, *Electrical properties, *Snowfall, Crystals, Storms, Weather, Air temperature, Lightning.
Identifiers: Electric charges (Particles).

Measurements of the charges on individual airborne snow particles showed that they were distributed approximately symmetrically between positive and negative values. The majority of the small charges were negative, however, and the majority of the large charges were positive. The magnitudes of the positive (or the negative) charges tended to follow a log-normal distribution. The mirror image relationship between the sign of the net charge carried by precipitation and the sign of the atmospheric potential gradient was generally found to hold, but some exceptions were noted. Even in the exceptional cases, however, changes in the atmospheric potential gradient affected the distribution of charges. (Knapp-USGS)
W70-09687

TOP WATER AND INTERSOIL RUNOFF OF SNOWMELT AND RAINFALL WATER,
Hydrometeorological Research Center, Moscow (USSR).
For primary bibliographic entry see Field 02G.

70-09710

ARIATIONS IN SOIL MOISTURE STORAGE URING THE WINTER HALF YEAR,
echnical Univ. of Building and Transport Engineering, Budapest (Hungary). Dept. of Water esources Development.
or primary bibliographic entry see Field 02G.
70-09711

IFLUENCE OF FREEZING AND THAWING UT PROCESSES ON MIGRATION AND SOIL OISTURE CONTENT IN THE UPPER AYERS OF THE UNSATURATED ZONE,
ydrometeorological Research Center, Moscow USSR).
or primary bibliographic entry see Field 02G.
70-09716

HE ISOTHERMAL COMPRESSIBILITY OF ROZEN SOIL AND ICE TO 30 KILOBARS AT - DEGREES C,
rmy Terrestrial Sciences Center, Hanover, N.H.
dwin Chamberlain, and Pieter Hoekstra.
esearch supported by Advanced Research Projects Agency of Dept of Defense. Cold Regions esearch and Engineering Laboratory Technical eport 225, June 1970. 35 p, 31 fig, 7 tab, 19 ref, ppend.

escriptors: *Ice, *Frozen soils, *Strength of aterials, *Compressibility, *Compressive rength, Stress analysis, Stress, Permafrost, nalytical techniques, Soil physical properties, aboratory tests, Mechanical properties, Deformaon, Elasticity (Mechanical), Compaction, iezometry, Pressure.
dentifiers: Ice compressibility.

he isothermal compressibilities of ice and parally and fully saturated sand and silt at -10 deg ere determined in a piston-die device with which uniaxial load is imposed on a lead encapsulated ecimen, resulting in the hydrostatic compression f the test specimen. Pressures to 30 kbars were obined. The compressibility of ice is as reported by .W. Bridgman. The various phase transformations f ice I to water ice VI to ice VIII appear as exected. It is shown that the compressibility of rozen soil can be readily predicted from the nowledge of material properties such as degree of aturation with ice, porosity, and the compressibilies of the ice and mineral components. (Knapp-SGS)
V70-09849

AN INSTRUMENTED EXPERIMENTAL SITE FOR THE INVESTIGATION OF SOIL MOISTURE, FROST, AND GROUNDWATER DISCHARGE,
Department of Energy, Mines and Resources, Otawa (Ontario). Inland Waters Branch.
R. A. Freeze, and J. A. Banner.
Canada Inland Waters Branch Report Series No 3, Department of Energy, Mines and Resources, 970. 29 p, 16 fig, 21 ref.

Descriptors: *Soil water movement, *Groundwater novement, *Frost, Freezing, Thawing, Saturated low, Unsaturated flow, Recharge, Surface-groundwater relationships, Base flow, Runoff, Water yield, nstrumentation, Infiltration, Hydrogeology, Data collections.
dentifiers: Calgary (Alberta, Canada).

An instrumented experimental site at Calgary, Alberta, Canada provides integrated measurements of the subsurface moisture regime in both the saturated and unsaturated zones. A soil-moisture measuring system utilizing both resistance cells and a neutron probe has advantages over single-instrument systems, particularly in the determination of frost and winter soil-moisture conditions. The site is in a regional groundwater recharge area. The vertical, saturated, hydraulic gradient is 0.45, and it remains remarkably constant through the year. Two mechanisms lead to water-table rises at the site: a direct vertical infiltration to the water table through the unsaturated zone, and a depression-focused recharge involving horizontal infiltration from a nearby slough. Frost formation occurs slowly from the surface down. An ice-water mixture precedes complete freezing. The spring thaw is more rapid but there is a significant remnant of the frost wedge in the ground at the time of peak snowmelt runoff. (Knapp-USGS)
W70-09850

2D. Evaporation and Transpiration

WATER BUDGET ACCOUNTING ON TWO CORN-CROPPED WATERSHEDS,
Agricultural Research Service, Brookings, S. Dak.
C. A. Onstad, and T. C. Olson.
Journal of Soil and Water Conservation, Vol 25, No 4, p 150-152, July-August 1970. 3 p, 3 fig, 5 tab.

Descriptors: *Water balance, *Corn (Field), *Evapotranspiration, Demonstration watersheds, Consumptive use, Soil moisture, Water storage, Water yield, Water conservation, Stubble mulching, Land management, Infiltration, Runoff, Soil-water-plant relationships, Water management (Applied).
Identifiers: Madison (S. Dak.).

The growing-season water budget components of two small corn-cropped watersheds in South Dakota were quantified over a 3-year period. The watersheds normall receive about 20 inches of rain between April 1 and October 31, little of which runs off. Most of the moisture evaporates or transpires. Evaporative demand is highest during June, July, and August, when a loss as much as four times the precipitation creates a moisture stress on corn during its critical growth period. Study data show that corn stover left as surface cover substantially increased the water retained on the watershed. (Knapp-USGS)
W70-09532

WATER TRANSMISSION BY EVAPORATION AND FROST ACTION AT DIFFERENT SOIL CONDITIONS IN SUCTION LYSIMETERS,
For primary bibliographic entry see Field 02G.
W70-09573

BASIN PEAT CULTURE FOR WATER ECONOMY,
Helsinki Univ. (Finland). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 02G.
W70-09574

EFFECT OF SOIL SALINITY ON THE LOSS OF WATER FROM VEGETATED AND FALLOW SOIL,
Geological Survey, Phoenix, Ariz.
For primary bibliographic entry see Field 02G.
W70-09579

METHODS AND FORMULAS FOR THE DETERMINATION OF SOIL EVAPORATION AND SOIL MOISTURE CONTENT FROM HYDROMETEOROLGICAL DATA,
Hydraulic Research Inst., Bratislava (Czechoslovakia).O
For primary bibliographic entry see Field 02G.
W70-09580

METHODS AND DEVICES FOR MEASURING MOISTURE, EVAPORATION AND AVAILABLE WET RATIO OF SOIL BASED ON THE ANALYSIS OF ITS HEAT REGIME,
Committee for the I.H.D., Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09582

WATER REGIME OF THE SOIL AS AFFECTED BY VEGETATION,
Research Inst. of Agricultural Economics, Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W70-09586

POTENTIAL EVAPOTRANSPIRATION OF MAIZE (FRENCH),
Institute of Irrigation Research, Prague (Czechoslovakia).
For primary bibliographic entry see Field 02G.
W70-09587

THE EXTRACTION OF SOIL MOISTURE BY PLANTS UNDER DRY LIMIT CONDITIONS,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
For primary bibliographic entry see Field 02G.
W70-09588

EVAPOTRANSPIRATION OF PLANTS AND FLUCTUATION OF THE GROUNDWATER TABLE,
State Inst. of Hydrology and Meteorology, Warsaw (Poland). Water Physics Div.
For primary bibliographic entry see Field 02G.
W70-09589

FIRST MEASUREMENTS OF SOIL WATER EVAPORATION WITH THE AID OF LYSIMETERS IN CZECHOSLOVAKIA (FRENCH),
Institute for Protection of Monuments and Nature, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 02G.
W70-09592

TRANSPIRATION OF SUGAR BEET,
Research Inst. of Irrigation Management, Bratislava (Czechoslovakia).
Vladimir Slama.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 748-759, 1968. 12 p, 7 tab.

Descriptors: *Evapotranspiration, *Water balance, *Sugar beets, Transpiration, On-site tests, Meteorology, Hydrologic budget, Solar radiation, Consumptive use, Moisture content, Soil-water-plant relationships.
Identifiers: Czechoslovakia.

The water requirement of sugar-beet plants was determined at the experimental station at Cakovice near Prague, Czechoslovakia during 1957-1960. In field experiments the balance of soil water was measured at intervals of three or four days during the vegetation period. The smoothed values of the consumptive use were the principal data for expressing the water requirement of sugar-beet in relation to meteorological factors through coefficients applied to the saturation deficit, evaporation and intensity of solar radiation. The consumptive use is expressed for ten-day periods and for periods in which the sum of mean daily temperatures is equal to 200 deg C. The coefficients were used for evaluating the quantity of irrigation water needed for sugar beet, and the measured changes in soil water content agreed well with those calculated. The method should be satisfactory in other regions. (See also W70-09715 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09714

THE REGULARITIES OF GROUNDWATER EVAPORATION IN IRRIGATION LANDS OF THE ARID ZONE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
D. M. Katz.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium,

The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 822-827, 1968. 6 p, 3 tab, 2 ref.

Descriptors: *Evaporation, *Arid lands, *Lysimeters, Irrigation, Irrigation water, Irrigation programs, Water demand, Consumptive use, Groundwater movement, Soil water movement, Surface-groundwater relationships.
Identifiers: *Groundwater evaporation, Soil water-groundwater relationships.

Lysimeter data are compiled for groundwater discharge and evaporation and transpiration from different types of ground surface (both land without vegetation and with cotton, alfalfa, maize and other irrigated crops). The investigations cover soils of various texture under semidesert and desert climatic conditions, with the water table at a depth of 0.5 to 3 meters. The results of mathematical treatment of the observation data are presented and pertinent regularities are established. (See also W70-09722 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09721

INFLUENCE OF TRANSPIRATION SUPPRESSANTS, SPRINKLER IRRIGATION AND MOISTURE LEVELS ON TRANSPIRATION AND EVAPOTRANSPIRATION,
Texas A and M Univ., College Station.
C. J. Gerard, and B. W. Hipp.
Available from the NTIS as PB-194 238, $3.00 in paper copy, $0.65 in microfiche. Texas A and M University Water Resources Institute Technical Report No 27, May 1970. 101 p, 33 fig, 36 tab, 29 ref. OWRR Project No B-033-TEX (1).

Descriptors: *Evapotranspiration control, *Sprinkler irrigation, Water utilization, Water yield improvement, Water conservation, Tomatoes, Citrus fruits, Texas.
Identifiers: Transpiration suppression.

Light sprinkler cooling water applications and white acrylic paint were applied to leaf canopies of tomatoes and citrus to attempt to reduce evapotranspiration. Moisture use, yields, and microclimatic data were determined. Estimates of influences of treatments on transpiration were evaluated with thermoelectric sensors. Tomato and citrus plant parts were analyzed for chemical effects of treatment. Diurnal changes in citrus tree trunks and fruits were monitored with linear variable displacement transducers. In 1968, the effects of treatments on water use were small and inconclusive. The white reflective treatment reduced water use by tomatoes by 10%, but reduced yields by 30% in 1969. Evaporative cooling increased yields of tomatoes in 1968 and 1969. In 1968, evaporative cooling increased total citrus yields and increased the tonnage of fruits which could be sold to fresh market. Evaporative cooling was effective in influencing fruit quality and size, and offers the promises of increasing the yield of quality produce and of making more efficient use of water. (Knapp-USGS)
W70-09830

A SIMPLE ENERGY BALANCE APPROACH TO THE MOISTURE BALANCE CLIMATOLOGY OF AFRICA,
McMaster Univ., Hamilton (Ontario). Dept. of Geography; and King's Coll., London (England). Dept. of Geography.
J. A. Davies, and P. J. Robinson.
In Environment and Land Use in Africa, Thomas, M. F. and Whittington, G. W. (Eds), Chapter 3, p 23-56, Methuen and Company, London, 1969. 33 fig, 4 tab, 42 ref.

Descriptors: *Climatic data, *Solar radiation, *Precipitation (Atmospheric), *Evapotranspiration, *Convection, Evaporation, Ecology, Latent heat, Advection, Climatic data, Climatic zones
Identifiers: *Potential water loss, *Africa, *Oasis effect, *Nigeria, *Bowen ratio, Net radiation, Climatic stations, Pans, Heating coefficient, Forest-savannah boundary.

Starting with the assumption that the ecologically significant climatic parameters are energy and moisture balances, the two are linked in theoretical and empirical equations so that measurements of one will have predictive value for the other. Net radiation (RN) at the Earth's surface is approximately equal to evaporation and sensible heat flux. Potential evapotranspiration (PE) then equals RN divided by the latent heat of vaporization of water. The potential water loss (ER) is the difference between rainfall (P) and PE in a given year, flecting either a water surplus or deficit with respect to a given crop and therefore predicting needed irrigation water. Inaccuracies may occur when the oasis effect due to advection is present. Regional weather stations and other data in Nigeria on solar and long-wave radiation facilitated the development of an empirical equation for ER. Sets of plus or minus values of P-ER were plotted against latitude. It was found that P-ER = O at forest-savannah boundaries, suggesting a rational climatic explanation for the existance of these boundaries, contrary to current ecological opinion. ER and P-ER maps are given for each month in Africa over areas from which radiation data are available. (Casey-Arizona)
W70-09962

DAYTIME STOMATAL CLOSURE IN AGAVE AMERICANA AS RELATED TO ENHANCED WATER-USE EFFICIENCY,
Agricultural Research Service, Phoenix, Ariz. Water Consevation Lab.
W. L. Ehrler.
In: Physiological Systems in Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 239-247, University of New Mexico Press, 1969.

Descriptors: *Stomata, *Evapotranspiration, Plant growth, Xerophytes, Corn (Field), Water vapor, Carbon dioxide.
Identifiers: *Leaf temperatures, *Assimilation, *Leaf diffusion resistance, *Water-use efficiency, *Transpiration ratios, Mesophytes, Agave, Succulents.

In greenhouse experiments with irrigated, growing corn and agave, transpiration, leaf temperatures, and leaf diffusion resistances were measured. Daytime leaf temperatures in corn were 1-2 degrees above room temperature whileagave leaf temperatures were 8-9 degrees higher. At night corn leaves were the same as, and agave leaves slightly lower than room temperature, indicating some evaporative cooling in agave. Expressed as percentage of daylight value, dark transpiration rates were 7 percent for corn and 200 percent for agave. Leaf diffusion resistances were completely out of phase, being high in the light for agave and high in the dark for corn. Both transpiration rates and leaf diffusion resistances showed that contrary to most plants, stomatal opening in agave is uninfluenced by light and largely occurs in the dark. Mean transpiration ratios were 136.0 for corn and 70.5 for agave. Dry weight gains were about equal in the 2 species indicating that water use efficiency of agave is about twice that of corn, illustrating a general quality of succulents. (Casey-Arizona)
W70-09964

2E. Streamflow and Runoff

FLOOD OF JULY 22, 1969 IN THE NORTHERN VIRGINIA AREA,
Geological Survey, Richmond, Va.
E. M. Miller, and F. P. Kapinos.
US Geological Survey Open-file report, 1970. 35 p, 21 fig, 1 plate, 3 tab.

Descriptors: *Storm runoff, Floods, *Rainfall-runoff relationships, *Virginia, *Historic flood, Runoff, Streamflow, Rainfall, Precipitation (Atmospheric), Stream gages, Data collections, Hydrologic data, Urbanization, Cities.
Identifiers: *Arlington (Va), Alexandria (Va), Fairfax County (Va).

Heavy rainfall during a thunderstorm on the night of July 22, 1969, produced record flooding in parts of the Washington metropolitan area. Runoff was the highest for the period of record at gaging sites in the Virginia suburbs. There was no loss of life, but hundreds of stores, homes, and apartment buildings were flooded, principally by Fourmile Run. Peak stages and discharges are given for 15 gaging stations and 6 miscellaneous sites. (Knapp-USGS)
W70-09530

SCALE EFFECTS IN THE PHYSICAL MODELING OF SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W70-09538

THE RELATIONS OF HYDROLOGY AND GEOMORPHOLOGY IN A HUMID TROPICAL STREAM BASIN - THE RIO GRANDE DE MANATI, PUERTO RICO,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
Lawrence A. Lewis.
Available from NTIS as AD-679 462, $3.00 in paper copy, $0.65 in microfiche. Final Report of National Research Council, Division of Earth Sciences, 1968. 130 p, 28 fig, 5 tab, 31 ref. ONR Contract N00014-67-0244-0001.

Descriptors: *Geomorphology, *Tropical regions, *Rainfall-runoff relationships, *Puerto Rico, Wet climates, Hydrogeology, Hydrographs, Stage-discharge relations, Hydraulics, Open channel flow, Sediment transport, Channel morphology, Duration curves, Drainage patterns (Geologic).
Identifiers: Rio Grande de Manati (Puerto Rico).

This study analyzes the manner in which the channel of the Rio Grande de Manati, located in north-central Puerto Rico, changes in cross section in both the downstream direction from its source waters to its mouth and at seven individual sites along the river. The basic parameters which were measured include the stream's width, depth, velocity, bed material size, and size of drainage area. The kinds of bedrock over which the streams flow and the nature of the river bank materials were noted. These measurements were made to determine what changes occur in individual river reaches as flow conditions vary; to resolve how the variables of width, depth, and velocity change in the downstream direction at a given frequency of discharge; to ascertain what is the hydraulic geometry of the Rio Grande de Manati; and to see if the concept of dynamic equalibrium is valid in a humid tropical stream basin. (Knapp-USGS)
W70-09566

DERIVING THE UNITGRAPH WITHOUT USING RAINFALL DATA,
Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
R. J. De Laine.
Journal of Hydrology, Vol 10, No 4, p 379-390, June 1970. 12 p, 2 fig, 6 tab.

Descriptors: *Unit hydrographs, *Runoff forecasting, *Rainfall-runoff relationships, Hydrograph analysis, Routing, Linear programming, Synthetic hydrology, Simulation analysis, Hydrographs, Mathematical studies.
Identifiers: Hydrograph synthesis.

The characteristic of a linear time invariant system can be found uniquely from any two outputs that have no error; it is not necessary to know the inputs or the time duration of the system response. In hydrologic terms, the unitgraph of a catchment with linear characteristics may be found from records of runoff vs time. (Knapp-USGS)
W70-09680

)TTOM CURRENTS NEAR THE COAST DUR-G HURRICANE CAMILLE,
uisiana State Univ., Baton Rouge. Coastal Stu-s Inst.
ephen P. Murray.
urnal of Geophysical Research, Vol 75, No 24, p 79-4582, August 20, 1970. 4 p, 3 fig, 15 ref. NR Contract Nonr 1575 (03) and NR 388-002.

escriptors: *Currents (Water), *Ocean currents, lurricanes, *Current meters, *Florida, Winds, p currents, Ocean waves, Waves (Water), asts, Storms.
entifiers: Hurricane Camille (1969).

ducted current meter, which was mounted on the ttom in 6.3 meters of water off the coast of the rida panhandle, was operative during much of activity of Hurricane Camille. Before the ar-al of the storm an unexpected outward extension the wave-driven longshore current was recorded. ring the storm bottom current speeds ranged up 160 cm/sec., and their direction rotated from ngshore parallel to the wind to seaward against wind. (Knapp-USGS)
70-09685

RAVELING CORRELATION FUNCTION OF HE HEIGHTS OF WIND-BLOWN WATER AVES,
aval Postgraduate School, Monterey, Calif. Dept Physics; and Wisconsin Univ., Middletown. eophysical and Polar Research Center.
Medwin, C. S. Clay, J. M. Berkson, and D. L. ggard.
urnal of Geophysical Research, Vol 75, No 24, p 19-4524, August 20, 1970. 6 p, 5 fig, 1 tab, 23 f.

escriptors: *Waves (Water), *Model studies, ydraulic models, Mathematical models, Ocean aves, Winds, Mathematical studies, Statistical odels, Correlation analysis.
entifiers: Wave tanks.

wind-blown water surface can be characterized terms of a traveling correlation function in which e group and phase velocities are given by the lues at the frequency of maximum spectral ener-density. The two-dimensional (space and time) rface displacement correlation function has been easured for low-divergence wind-blown waves in laboratory tank. The measured phase and group locities of the correlation function agreed with eoretical values for the peak frequency water-ave component when the measurements were ansformed to coordinates that had the velocity of e surface (drift) current. This description, which ay be useful in the ocean as well, has recently een used to predict the temporal correlation of und scattered from a model sea of known three-imensional surface correlation function. (Knapp-SGS)
70-09689

LOODS OF DECEMBER 1966 IN OUTHWESTERN UTAH,
eological Survey, Washington, D.C.
lmer Butler, and J. C. Mundorff.
or sale by Superintendent of Documents, US overnment Printing Office, Wash, D C. 20402. U Geological Survey Water-Supply Paper 1870-A, 970. 40 p, 12 fig, 2 plate, 6 tab, 8 ref.

escriptors: *Floods, *Utah, *Stage-discharge elations, Water levels, Discharge (Water), Histor-c flood, Hydrologic data, Data collections, Sedi-ent load, Silting, Soil erosion, Flood damage, uspended load, Bed load.
dentifiers: Virgin River (Utah).

evere floods occurred in parts of southwestern tah on Dec. 5-6, 1966, as a result of precipitation f about 1 inch to more than 12 inches during Dec. -6. The flood on the Virgin River was the greatest ince the first settlers arrived in 1860. The peak ischarge of the Virgin River at Virgin, Utah, was 2,800 cubic feet per second on Dec. 6; this exceeded the previous maximum discharge of 13,500 cubic feet per second on March 3, 1938, and Sept. 17, 1961, and probably has a recurrence interval of 100 years. The suspended-sediment discharge during the period Dec. 5-8, 1966, at Santa Clara River above Winsor Dam, near Santa Clara was about four times greater than all the suspended-sediment discharge during the preceding 3 years; the suspended-sediment discharge of the Virgin River at Virgin was greater during the 4-day period than during any one of the preceding 3 years. Total damage in the Dixie Soil Conservation District in Washington County was about $835,000; 60% of the damage was caused by floodwater and 40% by deposited sediment. (Knapp-USGS)
W70-09701

SUMMARY OF FLOODS IN THE UNITED STATES DURING 1964,
Geological Survey, Washington, D.C.
J. O. Rostvedt.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C. 20402 - Price $0.60. US Geological Survey Water-Supply Paper 1840-C, 1970. 124 p, 58 fig, 29 tab, 21 ref.

Descriptors: *Floods, *United States, *Historic flood, Flood damage, Hurricanes, Rainfall, Rainfall-runoff relationships, Stage-discharge relations, Water levels, Discharge (Water), Runoff, Streamflow, Data collections, Hydrologic data.
Identifiers: U. S. Floods (1964).

This report describes the most outstanding floods in the United States during 1964. The four most damaging floods during the year were in December in the Far Western States, in March along the Ohio River, in September in central and northern Florida and southern Georgia, and in June in northwestern Montana. The floods of December in the Far Western States were the most damaging in the history of the area. Record-breaking discharges occurred in an unusually large area--Oregon, northern California, western Nevada and Idaho, and southern Washington. Two storms in early March along the Ohio River caused maximum discharges of record on many streams in Ohio, Kentucky, and Indiana and also high discharges in part of Illinois, West Virginia, and Pennsylvania. In September, Hurricane Dora, the first hurricane of record to cross northeastern Florida from the Atlantic Ocean, caused outstanding floods in northern Florida and southern Georgia. The most severe floods of record in northwestern Montana occurred on both sides of the Continental Divide following heavy rains in early June. In addition to the floods mentioned above, 21 others of lesser magnitude are listed. (Knapp-USGS)
W70-09703

INFILTRATION AS A FACTOR AFFECTING RUNOFF COMPUTATIONS,
Prague Agricultural Univ. (Czechoslovakia).
For primary bibliographic entry see Field 02G.
W70-09723

ON THE THEORY OF LONGITUDINAL DISPERSION,
Hydronautics, Inc., Laurel, Md.
C. Elata.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1 - Microturbulent Diffusion and Dispersion), Paper D1, p 1-10, 1967. 10 p, 4 fig, 6 ref.

Descriptors: *Turbulent flow, *Dispersion, *Open channel flow, Mixing, Hydraulic radius, Turbulence, Roughness (Hydraulic), Reynolds number, Diffusion, Path of pollutants, Tracers, Tracking techniques, Mathematical studies, Streamflow.
Identifiers: Longitudinal dispersion.

A tracer injected in a uniform turbulent stream will, after a long period attain a Gaussian average-concentration distribution. A simplified conservation of mass equation, applicable to this condition, is written in orthogonal curvolinear coordinates in such a way that one of the coordinates coincides with the isovels of the stream. A general expression for the dispersion coefficient is derived, depending on the shear velocity, the hydraulic radius, the basic velocity profile and the metric coefficients of the coordinate system. This approach allows the numerical calculation of dispersion coefficients in streams in which velocities vary in the transverse as well as in the vertical direction, without a need for any additional assumptions concerning the dispersivity. Some simple calculations show that the non-dimensionalized dispersion coefficient varies only slightly with Reynolds number and boundary roughness. In elliptical channels, with various width to depth ratios, the dispersion coefficients depend heavily on the shape of the isovels. (Knapp-USGS)
W70-09734

ANALYTIC PREDICTION OF LONGITUDINAL DISPERSION COEFFICIENTS IN NATURAL STREAMS,
California Univ., Berkeley. Dept. of Civil Engineering.
Hugo B. Fisher.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D2, p 11-19, 1967. 9 p, 2 fig, 3 tab, 6 ref.

Descriptors: *Dispersion, *Turbulent flow, *Open channel flow, Alluvial channels, Mixing, Turbulence, Roughness (Hydraulic), Diffusion, Path of pollutants, Mathematical studies, Model studies, Mathematical models, Hydraulic models.
Identifiers: Longitudinal dispersion.

Field measurements of the longitudinal dispersion coefficient in natural streams have produced coefficients far greater than was expected from the analytic work of Taylor and Elder. The dispersive effect of the vertical gradient of downstream velocity, on which Elder's analysis was based, is overwhelmed by the far greater dispersive effect of horizontal (transverse) gradients. A method is given for predicting the dispersion coefficient of any natural stream, based on measurements of lateral velocity variations. To use the method field measurement is required of channel-sectional geometry, cross-sectional distribution of velocity, and slope. For most channels these measurements are either already available or may be easily obtained. The method has been proven accurate by a comprehensive series of laboratory experiments, and by experiments in one natural stream. (Knapp-USGS)
W70-09735

TRACER STUDIES ON TURBULENT DIFFUSION AND DISPERSION,
Chalmers Univ. of Technology, Goteborg (Sweden).
For primary bibliographic entry see Field 08B.
W70-09736

DIFFUSION OF WARM WATER JETS DISCHARGED HORIZONTALLY AT THE WATER SURFACE,
Chuo Univ., Tokyo (Japan). Hydraulic Lab.
Taizo Hayashi, and Nobuo Shuto.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D6, p 47-59, 1967. 13 p, 14 fig, 2 photo, 5 tab, 6 ref.

Descriptors: *Diffusion, *Mixing, *Jets, *Heated water, Open channel flow, Flow, Turbulent flow, Convection, Dispersion, Model studies, Hydraulic models.
Identifiers: Jet diffusion.

Several experiments were made on the diffusion of warm water jets discharged horizontally at the surface of initially quiescent water. The temperature was from 0.2 deg to 28 deg higher than the receiving water, the densimetric Froude numbers of the jets at an outlet varied from 16.1 to 1.4, and the Richardson numbers of the jets at the outlet varied from 0.00 to 0.54. An approximate theory was developed with the assumptions that: (1) The horizontal diffusion terms in the equation of motion equal the horizontal pressure gradient term; (2) the profiles of temperature in vertical sections are of similar form and the profiles of horizontal velocity in vertical sections are also of similar form; (3) the rate of entrainment at the bottom of the surface layer of warm water is proportional to some characteristic velocity at that vertical plane; (4) the turbulent-diffusion coefficients are constants. The experimental results were compared with the approximate theory, and the effect of Richardson number on the diffusion of warm water jet is discussed. (Knapp-USGS)
W70-09738

TURBULENT DIFFUSION OF THE VERTICALLY UPWARD JET,
Osaka Univ. (Japan). Dept. of Civil Engineering.
Akira Murota, and Kouji Muraoka.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D7, p 60-70, 1967. 11 p, 10 fig, 12 ref.

Descriptors: *Jets, *Mixing, *Dispersion, Diffusion, Turbulence, Turbulent flow, Velocity, Bubbles, Saline water intrusion, Estuaries, Water pollution control.
Identifiers: Vertical jets.

A water-curtain formed in a stream by a series of vertical jets from bottom to surface may be used as a barrier for the control of salinity intrusion in tidal reaches of rivers. Mixing of free jets in unbounded space is analyzed for cases of two and three dimensional jets. When the still water depth is larger than 20 times the representative length of injection nozzles, velocity decreasing along the jet axis is quite similar to that of free jets except in a stagnant region. Distributions of vertical velocity in the mixing region are given by Tollmien's theory. The proportional constant for vertical jets is about 3 times larger than that of free jets; thus nominal boundaries of vertical jets are more widely spread than those of free jets. (Knapp-USGS)
W70-09739

A LINEAR DISTRIBUTED MODEL OF CATCHMENT RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
For primary bibliographic entry see Field 02A.
W70-09831

HYDROLOGY OF WATER YIELD PREDICTION: METHODOLOGY FOR WATERSHED LOW-FLOW PREDICTION,
Oregon State Univ., Corvallis. Water Resources Research Inst.
John C. Campbell.
Available from the NTIS as PB-194 240, $3.00 in paper copy, $0.65 in microfiche. Oregon State University Water Resources Research Institute Project Completion Report, June 1970. 68 p, 7 fig, 11 tab, append. Project A-001-OREG.

Descriptors: *Low flow, *Streamflow forecasting, *Oregon, *Small watersheds, Probability, Rainfall-runoff relationships, Precipitation (Atmospheric), Frequency analysis.
Identifiers: Low-flow prediction.

Methodology was developed for prediction of low flow for small watersheds. Ten years of precipitation data were collected, adjusted, and analyzed for Deer Creek, Flynn Creek, and Needle Branch, Oregon. There was no really significant correlation between seasonal low-flow quantity and precipitation quantities for any previous period of time. A probability graph, based upon related previous discharge records, proved capable of predicting low-flow watershed yields normally within a 10% error. High-elevation reservoir systems for water storage can be utilized to retain 25 to 100% of annual water yield for later release, producing virtually uniform streamflow. (Knapp-USGS)
W70-09832

LINEAR-MOMENTUM FLUX TO OVERBANK SECTIONS,
Geological Survey, Atlanta, Ga.; and Georgia Inst. of Tech., Atlanta.
For primary bibliographic entry see Field 08B.
W70-09837

WATER WAVES GENERATED BY LANDSLIDES IN RESERVOIRS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02H.
W70-09839

SOME STATISTICAL PROPERTIES OF DENDRITIC CHANNEL NETWORKS,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
W. C. Krumbein, and Ronald L. Shreve.
Report available from NTIS as AD-705 625, $3.00 in paper copy, $0.65 in microfiche. Northwestern University, Department of Geological Sciences Technical Report No 13, April 1970. 118 p, 32 ref. ONR Contract 389-150 (Formerly 388-078).

Descriptors: *Geomorphology, *Drainage patterns (Geologic), *Drainage density, *Statistical models, *Topography, Geology, Structural geology, Statistical methods, Correlation analysis, Regression analysis, Joints (Geology), Erosion, Stream erosion.
Identifiers: Stream order, Drainage basin analysis, Topology.

Quantitative geomorphic measurements were made on modern 1:24,000-scale topographic maps for 90 order-3 and 90 magnitude-10 basins randomly selected from a 250 square-mile area of horizontal, homogeneous sandstones in eastern Kentucky. Operator variations were greatest in locating sources and least in measuring areas, and were readily reduced to acceptable limits by training and practice. Distributions of drainage density, relief, and outlet elevation are essentially the same in the two samples, whereas those of area, total channel length, and a shape measure are significantly narrower in the magnitude-10 sample. Simple and multiple linear correlation, and trend surface, factor, and discriminant function analyses were made to illuminate the differences between the samples, and hence between order and magnitude as the basis for classifying drainage-basin data. Similar measurements were made on 153 magnitude-5 basins in the study area. Cis and trans links have nearly equal probabilities but strongly differing length distributions. Link lengths do not vary significantly up to magnitude 1311. Total stream length and basin area are highly correlated, with a trend that supports the hypothesis that the areas draining into the sides of links ought to vary quadratically with link length in the smallest basins and directly with it in the largest. (Knapp-USGS)
W70-09843

HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1963,
Agricultural Research Service, Washington, D.C. Soil and Water Research Div.

For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $4.00. Harold W. Hobbs and James B. Burford, Compilers. US Department of Agriculture Research Service Miscellaneous Publication No 1164, July 1970. 465 p, 4 tab.

Descriptors: *Hydrologic data, *Agricultural watersheds, United States, Data collections, Research and development, Watersheds (Basins), Precipitation (Atmospheric), Runoff, Air temperature, Documentation, Planning, Storm runoff, Hydrographs, Hydrologic aspects.
Identifiers: *Agricultural experiment stations.

Selected hydrologic data are presented for calendar year 1963. Included are monthly precipitation and runoff records for 168 watersheds, annual maximum discharges and volumes of runoff for 156 of the basins for time intervals of 1, 2, 6, and 12 hours and for 1, 2, and 8 days, daily precipitation and discharge and or daily air temperature on 57 watersheds and detailed data for one or more selected typical storm events for 142 watersheds. Decimal page numbering used is consistent with that used in the five previous publications, so that previous records and general descriptions can be readily consulted. State agricultural experiment stations collaborated in selecting, planning, and operation of the studies, and the U.S. Geological Survey and State and local agencies assisted in the work. (Lang-USGS)
W70-09851

DIFFUSION OF SUBMERGED SLUICE GATE FLOW OVER A DROP,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09856

MATHEMATICAL MODELING OF DISPERSION IN RIVERS,
Vanderbilt Univ., Nashville, Tenn. School of Engineering.
Karl B. Schnelle, Jr., Edward L. Thackston, and Peter A. Krenkel.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D4, p 33-41, 1967. 9 p, 3 fig, 8 ref.

Descriptors: *Dispersion, *Streamflow, *Turbulent flow, Turbulence, Mathematical studies, Mixing, Sediment transport, Equations, Model studies, Open channel flow.
Identifiers: Longitudinal mixing.

Dispersion in turbulent streams is described by dividing the flow into a main stream and dead zone. Two coupled partial differential equations are written as a model of the dispersion. This dead zone model is shown to improve the statistical fit of experimental concentration-time data when compared to Taylor's dispersion model. An equation is suggested to predict the dispersion coefficient in natural streams if in short uniform reaches the dead zone model is used to describe the dispersion. (Knapp-USGS)
W70-09858

HYDRAULIC MODEL EXPERIMENT ON THE DIFFUSION DUE TO THE TIDAL CURRENT,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
For primary bibliographic entry see Field 02L.
W70-09859

MARKOV CHAIN MODELS OF TURBULENT DIFFUSION,
Cambridge Univ. (England). Cavendish Lab.
C. A. Greated.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D10, p 89-96, 1967. 8 p, 6 fig.

escriptors: *Diffusion, *Markov processes, Mathematical models, *Computer programs, Turlent flow, Dispersion, Dye releases, Tracking chniques, Tracers, Probability, Open channel w.
entifiers: Turbulent diffusion.

finite Markov Chain model is described for turlent diffusion. The model makes it possible to lve problems with complex boundary conditions a very simple way on a computer. Details are ven of the method of solution for three-dimenonal diffusion in homogeneous isotropic turbuace. The computations were carried through for a oblem on the two-dimensional diffusion of a oud. (Knapp-USGS)
70-09860

FFECT OF PARTICLE SIZES TO TURBUENT DIFFUSIVE PROCESSES IN FREE SURACE FLOW,
yoto Univ. (Japan). Dept. of Civil Engineering.
oshiaki Iwasa, and Hirotake Imamoto.
rench resume. Proceedings 12th Congress of the ternational Association for Hydraulic Research, pt 11-14, 1967, Colorado State Univ, Fort Colns, Vol 4 (Pt 1-Microturbulent Diffusion and ispersion), Paper D11, p 97-106, 1967. 10 p, 7 g, 1 ref.

escriptors: *Dispersion, *Particle size, *Sediment ansport, *Turbulent flow, *Mathematical models, odel studies, Turbulence, Open channel flow, elocity, Hydraulic models.
entifiers: Japan.

lass transport phenomena in a turbulent flow field re physical interactions between the turbulent naracteristics of the flow itself and the covective ovement of particles transported, so that the difsive process estimated through the observations f particle dispersions must be influenced by the hysical properties of particles used as a tracer. he hydrodynamic effect of particle sizes on the rbulent diffusive process of free surface flow are nalyzed by the use of a model obtained under the ssumption that the instantaneous velocity of a parcle is a volumetric mean value of the fluid velocies. Some observations in turbulent free surface ow are also provided to compare with the mathetical analysis. (Knapp-USGS)
V70-09861

XPERIMENTAL RESULTS OF DYE DIFFUION IN LARGE PIPELINES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09863

RADIAL DIFFUSION IN TURBULENT PIPE FLOW,
Illinois Univ., Urbana. Dept. of Civil Engineering; nd Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 08B.
W70-09864

TURBULENT DIFFUSION IN THE HYDRAULIC UMP,
Technische Hochschule, Karlsruhe (West Germany).
Max Breitenoder, and Heinrich Dorer.
French resume. Proceedings 12th Congress of the nternational Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D15, p 137-145, 1967. 9 p, 9 fig, 3 ref.

Descriptors: *Hydraulic jump, *Diffusion, *Turbulent flow, Turbulence, Tracers, Saline water, Model studies, Laboratory tests, Hydraulic models, Stage-discharge relations, Mixing, Vortices, Turbulence, Open channel flow.
Identifiers: Turbulent diffusion.

To permit studies of the turbulent diffusion in hydraulic jump, concentration tests were made with a salt solution used as tracer. The concentration was measured by electric conductivity tests, made directly in the flow. The tests, carried out for Froude numbers 2 to 7, showed that the degree of irregularity of the distribution of mean concentration is dependent on the Froude number. Perfect mixing (degree of irregularity equal to zero) shifts towards the starting point of the hydraulic jump with increasing Froude-numbers. (Knapp-USGS)
W70-09865

STOCHASTIC SIMULATION OF THE DIFFUSION OF JETS,
Carnegie Inst. of Tech., Pittsburgh, Pa.
For primary bibliographic entry see Field 08B.
W70-09866

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W70-09868

APPLICATION OF RADIOTRACER METHODS IN STREAMFLOW MEASUREMENTS,
T. Dincer.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/8, p 93-113, 1967. 21 p, 2 fig, 12 ref.

Descriptors: *Tracers, *Radioisotopes, *Tracking techniques, *Streamflow, *Discharge measurement, Stream gages, Water measurements, Discharge (Water), Mixing, Stage-discharge relations, Tritium, Sampling, Safety, Adsorption, Water chemistry.
Identifiers: Streamflow measurement.

An attempt is made to evaluate methods using radiotracers in streamflow measurements. The basic principles of the tracer method are explained and background information given. Radiotracers used in stream discharge measurements are discussed and measurements made by different research workers are described. Problems such as adsorption of the tracer and the mixing length are discussed and the potential use of the radioisotopes as tracer in the routine stream-gaging work is evaluated. It is concluded that, at the present stage of development, radiotracer methods do not seem to be ready for routine use in stream-gaging work, and can only be used in some special cases. For gamma-emitting radioisotopes there are problems related to safety, transport and injection which should be solved. Tritium, though a very attractive tracer in some respects, has the disadvantages of having a relatively long half-life and of disturbing the natural tritium levels in the region. An attempt is made to define the objectives of the research in the field of application of radioisotopes in hydrometry. (See also W70-09868) (Knapp-USGS)
W70-09874

TRANSFORMATION OF RIVER WATER AT THE MOUTH OF A RIVER AND SOME CRITERIA OF POLLUTION,
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 02K.
W70-09946

THE DRY SEASON FLOW CHARACTERISTICS OF WEST AFRICAN RIVERS,
Edinburgh Univ. (Scotland). Dept. of Forestry and Natural Resources.
D. C. Ledger.
In Environment and Land Use in Africa, Thomas, M. F. and Whittington, G. W. (editors), Chapter 5, p 82-102, Methuen, London, 1969. 8 fig, 2 tab, 9 ref.

Descriptors: *Dry seasons, *Rainfall, *River flow, *River systems, *Surface runoff, Tropical regions, Arid lands, Groundwater recharge, Floodplains.
Identifiers: *West Africa, *Intertropical convergence zone, *Niger River.

The climate of West Africa is controlled by seasonal migration of the intertropical convergence zone between 9-20 degrees north. Rainfall in maritime regions is zonal and decreases inland with latitude. An east-west geological boundary exists at 12 degrees north. The southern region consists of highland blocks while the northern region comprises vast depositional plains. Streamflow is influenced by drainage basin size. In small basins direct run-off passes the outlet point quickly and dry season flow ceases unless groundwater discharge occurs. Large rivers have similar dry season over-all flow patterns but take much longer to recede from high wet season to low dry season flow. In the rivers with large floodplains, water storage in shallow lakes during high periods and water release during low periods combine with phasic differences in wet and dry periods over widely separated parts of their courses creating compensatory effects resulting in less variable year-round flow. The Niger River is an outstanding example and flow is analyzed over its entire course. (Casey-Arizona)
W70-09963

2F. Groundwater

GROUNDWATER IN KEARNY COUNTY, SOUTHWESTERN KANSAS,
Geological Survey, Garden City, Kans.
E. E. Gutentag, D. H. Lobmeyer, and H. E. McGovern.
U S Geological Survey Open-file report, 1970. 40 p, 18 fig, 4 tab, 7 ref.

Descriptors: *Hydrogeology, *Aquifers, *Kansas, Hydrologic data, Water resources, Water resources development, Data collections, Irrigation water, Water wells, Sandstones, Alluvium, Water level fluctuations, Geology.
Identifiers: Kearny County (Kans.).

Groundwater may be developed in Kearny County, Kansas, from Jurassic and Cretaceous sandstones and from Tertiary and Quaternary alluvium. The Upper Jurassic rocks consist of a fine-grained silty sandstone unit overlain by a variegated shale and dark-gray sandy shale unit. The Lower Cretaceous rocks consist of the Cheyenne Sandstone (a fine-to medium-grained sandstone interbedded with shale), the Kiowa Shale (predominantly shale interbedded with thin sandstone layers), and the Dakota Formation (a fine- to medium-grained sandstone interbedded with sandy shale and shale). The thickness of the sandstone aquifer ranges from about 350 to 500 feet. Because the aquifer includes numerous beds of shale and sandy shale and because the sandstone beds commonly are silty or tightly cemented, the yield of groundwater to wells may be sufficient only for domestic or stock supplies. The Tertiary and Quaternary deposits are hydrologically connected and are considered as one aquifer. Because these deposits consist of alternating lenses of fine- and coarse-grained alluvial sediments, groundwater movement is retarded vertically and laterally. Thus, the water-yielding capacity of the aquifer differs from one area to another, and the water may be semiconfined (semiartesian) or unconfined. The increasing use of groundwater for irrigation has resulted in a decline in water levels and a gradual loss of water in storage. (Knapp-USGS)
W70-09544

GROUNDWATER RESOURCE EVALUATION,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
William C. Walton.
New York, N.Y., McGraw-Hill Book Company, 1970. 664 p.

Descriptors: *Groundwater, *Groundwater movement, *Hydrology, *Hydrogeology, *Water resources development, Aquifers, Water wells, Water yield, Water storage, Surveys, Investigations, Hydraulics, Hydrodynamics, Unsteady flow, Systems analysis, Mathematical models, Analog models, Water management (Applied), Water quality.
Identifiers: Aquifer testing, Pumping tests.

A textbook presents both the basic principles of groundwater resource evaluation and the practical application of techniques to well and aquifer problems. Derivation of equations as well as numerous illustrative case histories of analyses based on actual field data are presented. Numerous practical problems which may be solved with available equations, and methods of analysis are given. A comprehensive bibliography is presented containing references to the literature germane to groundwater resource evaluation. Equations and analytical methods most frequently applied to actual groundwater resource evaluation field problems are presented. They include equations and methods used to quantitatively appraise the hydrogeologic parameters affecting the water-yielding capacity of wells and aquifers, and equations and methods used to quantitatively appraise the response of wells and aquifers to heavy pumping. This book, in addition to serving as a text for groundwater courses, should aid in the systematic appraisal of groundwater resource problems by practicing engineers and geologists. (Knapp-USGS)
W70-09551

OPTIMAL RESOURCE USE OVER TIME WITH AN APPLICATION TO GROUNDWATER,
California Univ., Davis.
Oscar R. Burt.
Management Science, Vol 11, No 1, p 80-93, September 1964. 19 ref, 2 append.

Descriptors: *Time, *Groundwater, Decision making, Resource allocation, Supply, Dynamic programming.
Identifiers: *Optimal resource use, *Resource use, Decision rules, Storage control.

This paper is concerned with optimal allocation over time of a single resource which is either fixed in supply or only partially renewable at a point in time. Some resources which fall in this category are mineral deposits, groundwater, petroleum, wildlife, and fish. A functional equation is obtained from a dynamic programming formulation of the problem. This functional equation is used to derive approximate decision rules for resource use as a function of current supply. The results are applied to groundwater storage control and tested empirically by comparison with a decision rule obtained by detailed numerical methods. (Loeb-Rutgers)
W70-09649

ANALYSIS OF DATA FROM PUMPING TESTS IN UNCONFINED ANISOTROPIC AQUIFERS,
Norman S. Boulton.
Journal of Hydrology, Vol 10, No 4, p 369-378, June 1970. 10 p, 2 fig, 2 tab, 6 ref.

Descriptors: *Groundwater movement, *Transmissivity, *Data processing, Hydrologic data, Permeability, Steady flow, Unsteady flow, Drawdown, Water levels, Water table, Water Storage, Storage coefficient, Aquifers, Water level fluctuations, Water yield.
Identifiers: Pumping tests, Aquifer tests.

The errors involved in finding the coefficients of transmissibility and storage using pumping-test data are briefly discussed. Distance-drawdown data are advocated as generally most suitable for finding the transmissibility. Procedures are based on distance-drawdown analysis with constant storage coefficient and time-drawdown analysis with delayed yield from storage. Anomalies which result from well-known methods of analysis are illustrated by pumping test data. The methods described assume a fully-penetrating pumped well and shallow observation wells, except in the case of a very deep aquifer. A computer is not required. An exact equation, allowing for the vertical velocity-component of the flow and delayed yield from storage, is given. (Knapp-USGS)
W70-09681

SUMMARY RECORDS OF SUPPLY WELLS AND TEST WELLS IN THE POST HEADQUARTERS AREA, WHITE SANDS MISSILE RANGE, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
James B. Cooper
U S Geological Survey Open-file report, July 1970. 202 p, 87 fig, 74 tab, 9 ref.

Descriptors: *Groundwater, *Water resources development, *Surveys, *New Mexico, Water wells, Aquifers, Alluvium, Water levels, Water quality, Water yield, Sampling.
Identifiers: White Sands Missile Range (N Mex).

Data that have been collected from the drilling, construction, testing, water sampling, and water-level measurement of all supply and test wells in the Post Headquarters area, White Sands, Missile Range, are summarized. The area of the Post Headquarters is in a reentrant between the Organ Mountains on the south and west and the San Augustin and San Andres Mountains on the north; it merges with the Tularosa Basin on the east. The total relief of the area is nearly 5,000 feet. The reentrant is underlain by unconsolidated or semiconsolidated bolson deposits consisting of alternating layers of clay and sand and some gravel. The thickness of the bolson deposits has not been well established by test drilling; however, geophysical exploration indicate that it ranges from 250 feet near the mountains to 4,000 feet along the eastern edge of the reentrant. Farther to the east in the basin proper, bolson deposits exceed 6,000 feet in thickness. The depth to water ranges from about 50 to more than 400 feet. The chemical quality of water within the reentrant is good. The shallow water farther east in the Tualrosa Basin is highly saline. Summary records of supply wells, diagrams showing the construction and lithology of individual supply wells, chemical analyses of water samples collected from the supply wells, graphs showing the annual pumpage from each supply well, and hydrographs of the supply wells are tabulated. Summary records of test wells, diagrams showing the construction and lithology of individual tests wells, chemical analyses of water samples collected from the test wells, and hydrographs of the test wells are also presented. (Knapp-USGS)
W70-09684

ANALYSIS OF A RECONNAISSANCE GRAVITY SURVEY FOR DRIFT-FILLED VALLEYS IN THE MERCER QUADRANGLE, PENNSYLVANIA,
Naval Oceanographic Office, Washington, D.C. Magnetics Div.; and Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
William E. Rankin, and Peter M. Lavin.
Journal of Hydrology, Vol 10, No 4, p 418-435, June 1970. 18 p, 6 fig, 17 ref.

Descriptors: *Gravity studies, *Surveys, *Alluvial channels, *Aquifers, *Pennsylvania, Water resources development, Sands, Gravels, Glacial drift, Seismic studies, Statistical methods, Geophysics, Analytical techniques, Hydrogeology.
Identifiers: Mercer (Penn).

The effectiveness of a standard polynomial trend removal technique and two-dimensional wavenumber biltering in isolating gravity anomalies due to buried preglacial drainage systems was evaluated for an area in northwestern Pennsylvania. It was found that gravity surveying is a useful reconnaissance technique in this area. Both analytical methods isolated anomalies due to valleys of major hydrological interest, provided similar useful information on the valley trends, and gave reasonably accurate width estimates. Accurate depth estimates could not be inferred, although large anomalies generally coincided with thicker drift accumulations. With the station spacing used (about 0.75 miles), valleys sought must have drift accumulations in excess of 75 feet and widths of at least one mile if they are to be adequately resolved. The two-dimensional filtering method seems to offer the most complete information, while still being practical, and it avoids many of the problems of the polynomial method. (Knapp-USGS)
W70-09686

EVALUATION OF SELECTED COBALT-60 COMPLEXES AS TRACERS OF GROUNDWATER,
Northeast Louisiana State Coll., Monroe. Dept. of Chemistry; and Agricultural Research Service, Oxford, Miss.
For primary bibliographic entry see Field 07B.
W70-09691

MISSOURI - LAND OF WATER,
Stephen C. Casteel.
Water and Sewage Works, Vol 117, No 8, p 284-287, August 1970. 4 p, 1 tab, 3 ref.

Descriptors: *Springs, *Missouri, Water yield, Discharge (Water), Water utilization, Streamflow, Karst, Limestones, Groundwater movement.
Identifiers: Missouri springs.

The Big Spring country of Missouri has an unusual density and size of springs within a relatively small area. The discussion includes 47 springs in Missouri having a total outflow of 1.346 bgd, and one in Arkansas with a total of 864 mgd. There are more than 500 known springs in Missouri. (Knapp-USGS)
W70-09695

A GLOSSARY OF KARST TERMINOLOGY,
Geological Survey, Washington, D.C.
Watson H. Monroe.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D C. 20402 - Price $0.25. U S Geological Survey Water-Supply Paper 1899-K, 1970. 26 p, 11 ref.

Descriptors: *Karst, *Geomorphology, Groundwater movement, Hydrogeology, Publications, Technical writing.
Identifiers: Glossary (Karst terminology).

This glossary includes most terms used in describing karst geomorphologic features and processes. The terms are primarily those used in the literature of English-speaking countries, but a few of the more common terms in French, German, and Spanish are included, with references to the corresponding English terms where they are available. The glossary also includes simple definitions of the more common rocks and minerals found in karst terrain, common terms of hydrology, and a number of the descriptive terms used by speleologists. The glossary does not include definitions of most biospeleological terms, geologic structure terms, varieties of carbonate rock that require microscopic techniques for identification, or names describing tools and techniques of cave exploration. (Knapp-USGS)
W70-09702

HYDROGEOLOGICAL MAPS OF KOREA - VOL 1, ANSEONG RIVER BASIN, (KOREAN),
Geological Survey of Korea, Seoul.
Jeong Ung Lim, and Chang Ju Cho.
Geological Survey of Korea Hydrogeological Maps, Vol 1, 1969. 48 p, 22 fig, 15 tab, 5 photo, 16 ref.

Descriptors: *Hydrogeology, *Surveys, *Water resources development, Aquifers, Water yield, Alluvium, Water wells, Transmissivity, Permeability.
Identifiers: Korea, Anseong River basin.

esults are presented of hydrogeological studies in ne Anseong River basin in the central part of the orean peninsula. The geology of the area mainly onsists of biotite granite, gneiss and mica schist. ufficient groundwater can be developed from edrock only from the highly weathered zone and om alluvium. The thickness of the alluvial eposits range up to about 9 meters at the vicinity f Anseong town and 12 meters at the Pyeongtaek rea. In order to determine the hydraulic constants n this basin, more than 20 aquifer tests were caried out. The most favorable area of the basin is the nner part of the Pyeongtaek plain. The coefficients f transmissibility are 0.8 to 3.0 sq m/min, and the afe yields are more than 500 cu m perday for every umping well. The possible total amounts of the roundwater developed could be more than 30,000 cu m per day in years of average annual recipitation and at least 1,100,000 cu m per day in he irrigational season. (Knapp-USGS)
W70-09706

THE KARST LANDSCAPE OF YUCATAN,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
For primary bibliographic entry see Field 02J.
W70-09707

DETERMINATION OF STORAGE COEFFICIENTS FROM OBSERVATION OF GROUNDWATER LEVELS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09708

UNSATURATED SOIL MOISTURE CONDITIONS STUDIED FROM FIELD OBSERVATIONS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09709

EFFECT OF CAPILLARITY ON DISCHARGE OF WATER IN PERMEABLE AQUIFERS CONFINED BY ROCKS WITH SMALL INTERSTICES (FRENCH),
E. Berkaloff.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 909-921, 1968. 13 p, 4 fig, 2 ref.

Descriptors: *Soil water movement, *Groundwater movement, *Capillary fringe, *Water table, Infiltration, Water yield, Saturated flow, Unsaturated flow, Mathematical studies, Percolation.
Identifiers: Capillary fringe movement.

Because the catchment of water in poorly permeable formations is an important problem, water circulation in fine interstitial rocks is discussed. If the effects of capillarity in the calculation of yield are neglected, underestimation results when the capillary fringe is no longer negligible compared to the thickness of the saturated permeable rock. (See also W70-09714 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09713

RELATIONSHIP BETWEEN INFILTRATION AND GROUNDWATER HOUSEHOLD,
National Water Authority, Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W70-09719

THE METHOD OF GROUNDWATER RECHARGE EVALUATION IN SAND DESERT BY INVESTIGATION OF MOISTURE EXCHANGE IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09720

THE TYPE SECTIONS OF ROCK MOISTURE IN THE ZONE OF AERATION AND ESTIMATION OF INFILTRATION VALUES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09722

AN ESTIMATION OF MOISTURE DYNAMICS IN THE ZONE OF AERATION AND GROUNDWATER RECHARGE BY THE HEAT-MOISTURE TRANSFER,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
For primary bibliographic entry see Field 02G.
W70-09724

STUDY ON SALT WATER INTRUSION INTO GROUNDWATER - PART 1. GEOHYDROLOGIC CONDITIONS OF LAVA AQUIFER (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Toshio Murashita, and Kazuo Kishi.
Bulletin of Geological Survey of Japan, Vol 18, No 6, p 1 (379)-14 (392), June 1967. 14 p, 10 fig, 5 ref.

Descriptors: *Saline water intrusion, *Aquifers, Groundwater movement, Pumping, Withdrawal, Artesian wells, Lava, Sands, Fissures (Geology), Transmissivity.
Identifiers: Japan, Fuji.

In many coastal areas of Japan aquifers have been contaminated with salt water because the seaward flow of groundwater has decreased. The greatest salt-water contamination is in the coastal area along Suruga bay. The contamination first began in the vicinity of Tago-no-ura in 1960, and next on the reaches of Numa River in 1965. The contaminated area in 1966 is ten square kilometers in total. The pumping artesian aquifer is the Fuji lava beds, which has many fissures and caves, and is very permeable. Evidence of the industrial well field indicates that the interface between the fresh water and salt water receded because rainfall was heavy and new wells were no longer developed in 1966. Contamination continues on the reaches of Numa River, because the pumpage continues to increase. (See also W70-09733). (Knapp-USGS)
W70-09732

STUDY ON SALT WATER INTRUSION INTO GROUND WATER - PART 2. GEOCHEMICAL RESEARCH OF SALT GROUNDWATER (JAPANESE).
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02K.
W70-09733

AN INSTRUMENTED EXPERIMENTAL SITE FOR THE INVESTIGATION OF SOIL MOISTURE, FROST, AND GROUNDWATER DISCHARGE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02C.
W70-09850

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W70-09868

ESTIMATING THE TRITIUM INPUT TO GROUNDWATER FROM WINE SAMPLES: GROUNDWATER AND DIRECT RUN-OFF CONTRIBUTION TO CENTRAL EUROPEAN SUFACE WATERS,
Heidelberg Univ. (West Germany). Physikalis ches Institut.
W. Roether.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/7, p 73-91, 1967. 19 p, 7 fig, 3 tab, 21 ref.

Descriptors: *Fallout, *Tritium, *Sampling, *Fruit crops, Groundwater, Surface waters, Rainfall, Soil water, Crops, Soil-water-plant relationships, Tracers, Tracking techniques.
Identifiers: German Federal Republic, Wines, Grapes, Vineyards.

A model is derived which allows a quantitative evaluation of wine tritium data. The tritium content of a wine sample is not determined exclusively by water taken up by the roots, but is also influenced to a large extent by direct exchange with atmospheric moisture. The soil-water fraction amounts normally to not more than 40%. Thus, wine is a sample partly of atmospheric moisture at ground level, partly of soil moisture, integrated over a period around three weeks before vintage. The tritium content of two sets of wine samples originating from two selected sites in the Federal Republic of Germany and dating back to 1949 is reported. For the period before 1955 the tritium activity of the annual groundwater recharge, including pre-thermonuclear recharge in Central Europe, is estimated from the wine data. (See also W70-09868) (Knapp-USGS)
W70-09873

DATING OF GROUNDWATER WITH TRITIUM AND C14,
Heidelberg Univ. (West Germany). Physikalisches Institut.
K. O. Munnich, W. Roether, and L. Thilo.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/21, p 305-320, 1967. 16 p, 10 fig, 10 ref.

Descriptors: *Radioactive dating, *Groundwater, *Tritium, *Carbon radioisotopes, Fallout, Groundwater movement, Recharge, Ion exchange, Adsorption, Water chemistry, Mixing, Diffusion.
Identifiers: Germany, Rhine River.

Shallow groundwater can be dated with some accuracy on the basis of its bomb tritium content if the unsaturated soil cover and the aquifer itself are sufficiently homogeneous. A few examples from the Rhine valley are presented. The decrease in tritium level from the water table to a few meters below is nearly two orders of magnitude. Agreement between the measured or estimated variation of bomb tritium in rain during the past decade and the tritium found in shallow groundwater can be obtained if one takes into account that (a) practically no rain reaches the water table, and (b) water is mixed by diffusion. Both effects can also be observed in the soil moisture of the unsaturated soil above the water table. Carbon-14 increase in groundwater due to bombs is delayed compared to tritium, the reasons being delay in the biological system and exchange with the carbonate in the soil. A simple model is presented, which allows the evaluation of the influence of exchange on the C-14 age obtained. The deviation from the true age depends on the ratio of the carbonate content in the aquifer material to the carbonate content of the water, on the specific contact surface or the grain size, but not on the groundwater velocity. (See also W70-09868) (Knapp-USGS)
W70-09885

MODEL EXPERIMENTS FOR C-14 WATER-AGE DETERMINATIONS,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
I. Wendt, W. Stahl, M. Geyh, and F. Fauth.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/22, p 321-337, 1967. 17 p, 11 fig, 4 tab, 6 ref.

Descriptors: *Radioactive dating, *Groundwater, *Carbon radioisotopes, Calibrations, Ion exchange, Fallout, Mixing, Water chemistry, Carbonates, Carbon dioxide, Model studies, Laboratory tests.
Identifiers: Germany, Groundwater dating.

The C-14 age of water samples is calculated by assuming that fossil carbonate is dissolved by biogenic CO2. To investigate the mechanism of the dissolution, laboratory experiments were carried out under controlled conditions. Non-radioactive CaCO3 and radioactive CO2 were used to check the validity of theoretical assumptions regarding the average C-14 activity and the C-13 value of the total carbon which is dissolved as CO2 and HCO3. Exchange between the undissolved carbon present in the CaCO3 and that present in the HCO3 was also studied. In the simple CaCO3-CO2 system the assumption of no exchange is not justified even for a constant water temperature. Correction for the initial C-14 activity by means of the C-13 value is not consistent, and the reliability of the C-14 dating method is questionable. (See also W70-09868) (Knapp-USGS)
W70-09886

SURFACE-WATER INFILTRATION AND GROUNDWATER MOVEMENT IN ARID ZONES OF VENEZUELA,
Instituto Venezolano de Investigaciones Cientificas, Caracas.
M. A. Tamers.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/23, p 339-353, 1967. 15 p, 5 fig, 1 tab, 20 ref.

Descriptors: *Groundwater movement, *Radioactive dating, *Deserts, *Carbon radioisotopes, Carbonates, Water chemistry, Leaching, Ion exchange, Fallout, Stable isotopes, Aquifers, Limestones, Infiltration, Mixing, Evaporation.
Identifiers: Venezuela.

Radiocarbon dating of the carbonate species present in groundwater is capable of furnishing information on the recharge of underground deposits as well as directions and rates of movement. The origins of the dissolved carbonates fall under two classifications: modern carbon is provided by carbon dioxide from the atmosphere and the products of plants in the soil, and ancient carbon comes from dissolving limestone. The latter source is essentially free of radiocarbon and, therefore, causes falsely old dates for the total groundwater carbonates. An estimate of the amount of limestone dilution is the main difficulty connected with radiocarbon dating of groundwater. The methods proposed for this correction were applied to several aquifers under different conditions. Aquifers of Barquisimeto, Maracaibo, Coro, Paraguana, and Valencia in Venezuela were investigated by the method of natural radiocarbon. Ages ranging from modern to 35,000 yr were obtained. In general, the older dates correlate well with arid climatic conditions. However, deep wells providing modern water have been observed in virtual deserts, but these are explained by the recharge of irrigation water previously extracted from the ground. (See also W70-09868) (Knapp-USGS)
W70-09887

2G. Water in Soils

A COMPLETION REPORT ON SYSTEM SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME-V - STOCHASTIC DEMAND PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09518

ADSORPTION OF VIRUSES ON MINERAL SURFACES,
Maine Univ., Orono. Water Resources Research Center.
For primary bibliographic entry see Field 05B.
W70-09520

PERSISTENCE OF PESTICIDE RESIDUES IN SOILS,
Agricultural Research Service, Beltsville, Md. Crops Research Div.
For primary bibliographic entry see Field 05B.
W70-09562

EFFECT OF MEMBRANE PORE SIZE ON THE MEASUREMENT OF WATER TENSION IN BENTONITE SUSPENSIONS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
Amos Banin, Brian G. Davey, and Philip F. Low.
Soil Science of America Proceedings, Vol 32, No 2, p 306-309, May-June 1968. 4 p, 5 fig, 9 ref.

Descriptors: *Membrane processes, *Porosity, *Clay minerals, *Moisture tension, *Osmosis, Osmotic pressure, Turbidity, Colloids, Tensiometers.
Identifiers: Clay-water systems.

A pressure-transducer tensiometer and a dynamic osmometer were used to measure water tensions and osmotic pressures in clay-water systems. The two methods of measurement produced the same results. Different membranes, having pore sizes ranging from 0.004 to 0.8 microns were used with the tensiometer. Measured water tension of a given system depended on the pore size of the membrane; as the pore size increased, the tension decreased. However, little or no turbidity appears in a solution when it is separated from a clay suspension by a membrane having pores this small; therefore, the relationship between pore size and tension was not due to differences in membrane permeability to the clay particles. Nor was it due to differences in membrane permeability to dissolved solutes. No lasting tension developed when a NaCl solution or an extract of the clay were utilized in place of the clay suspensions. Two possible explanations were proposed: (1) entrance of particles into the pores was all that was required to lower the reflection coefficient, and (2) the gelation of the clay suspensions within the pores produced gels having particle densities and arrangements and, hence, permeabilities to dissolved solutes, that were dependent on the dimensions of these pores. (Knapp-USGS)
W70-09567

ENERGY RELATIONS IN WATER TRANSPORT AND SUPPLY OF WATER BY CAPILLARY RISE,
Agrophysical Inst., Leningrad (USSR).
N. Bondarenko, and S. Nerpin.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 527-535, 1968. 9 p, 6 fig, 10 ref.

Descriptors: *Soil water movement, *Water properties, *Viscosity, *Plasticity, *Yield strength, Rheology, Flow, Porous media, Unsaturated flow, Darcys law, Hydrogen bonding, Laboratory tests, Hydraulic gradient, Hydraulic conductivity.
Identifiers: Bingham bodies, Visco-plastic properties.

It is shown that water, including pure water, is not an exact Newtonian liquid and should be characterized as a Bingham body by two coefficients: plastic viscosity, and yield stress of order 0.01 dyne/sq cm. The yield stress of pure water may be caused by the formation of quasi-crystalline molecular frames due to hydrogen bonds. Taking into account the full rheological characteristics of water, it is possible to explain the deviation of water flow in porous media from Darcy's law (in the case of full saturation) and from the analogous relation for unsaturated soils. The influence of visco-plastic properties of water on equilibrium and transfer of water in unsaturated zone is shown. The data obtained give a rigorous physical base to predict and control soil moisture content. (See also W70-09569) (Knapp-USGS)
W70-09568

DEVELOPMENT OF EQUATIONS DESCRIBING TRANSPORT OF MASS, MOMENTUM AND ENERGY IN SOILS,
Agricultural Research Service, Madison, Wis.; and Illinois Univ., Urbana.
P. A. C. Raats, and A. Klute.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 535-546, 1968. 12 p, 23 ref.

Descriptors: *Soil water movement, *Mass transfer, *Energy transfer, *Momentum transfer, Soils, Thermodynamics, Flow, Porous media, Entropy, Physicochemical properties, Energy budget, Heat balance, Continuity equation.
Identifiers: Soil transport equations, Multiphase flow, Mixtures, Continuum theory.

A theory of mixtures is used as a basis for the construction of a macroscopic, comprehensive theory for transport of mass, momentum, and energy in soils. An unsaturated soil is regarded as a mixture of a solid phase, an aqueous phase, and a gaseous phase. Balances of mass, momentum, and energy are written for the phases. The necessary and sufficient assumptions for the force balance of the aqueous phase to reduce to Darcy's law are stated. From the balance of energy and the Gibb's equation, a balance of entropy is derived. It is pointed out that there are indications that the foundations of thermodynamics of irreversible processes are not as evident and as clear as one is often led to believe. (See also W70-09570) (Knapp-USGS)
W70-09569

EFFECT OF COMPACTNESS AND INITIAL MOISTURE CONTENT OF THE SOIL ON THE PROCESS OF CAPILLARY RISE,
Technical Univ. of Building and Transport Engineering, Budapest (Hungary). Dept. of Water Resources Development.
I. Ijjas.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 547-559, 1968. 13 p, 9 fig.

Descriptors: *Capillary action, *Soil water movement, *Soil structure, Moisture content, Capillary conductivity, Mathematical studies, Soil compaction, Soil density, Soil horizons, Soil moisture, Soil moisture meters, Tracers.
Identifiers: Initial moisture content.

The effect of compactness and initial (natural) moisture content of the soil on the process of capillary rise and on capillary transmissivity is discussed. The analog between deviations of capillary characteristics in soils of identical grain size distribution, but with different compactness and initial moisture

ntent, and those in soils of different grading is ex-
nined. A comparison is made between capillary
ocesses taking place in soils composed of two
ers. Characteristics of capillary flow directed
wards and enclosing an angle between 0 and 90
g with the horizontal are also studied. (See also
70-09571) (Knapp-USGS)
70-09570

IE DYNAMICS OF CAPILLARY RISE,
mmonwealth Scientific and Industrial Research
ganization, Canberra (Australia). Div. of Plant
lustry.
R. Philip.
nch resume. In: Water in the Unsaturated Zone,
l II, Proceedings of the Wageningen Symposium,
e Netherlands, June 19-25, 1966, International
sociation of Scientific Hydrology, Publication
83, p 559-564, 1968. 6 p, 3 fig, 5 ref.

scriptors: *Capillary action, *Soil water move-
nt, *Mathematical studies, Capillary conductivi-
Unsaturated flow, Soil moisture, Equations.
ntifiers: Linearization, Similarity method.

e problem of the dynamics of capillary rise as-
iated with the sudden immersion of the bottom
a soil column in free water (and of the cor-
ponding sub-irrigation problem) is examined.
'exact' method developed for analyzing the
amics of one-dimensional infiltration is ap-
priate at small times, but problems of conver-
ce set limits to its applicability. The equilibrium
ation approached at large times is, of course,
dily found; but the 'exact' bridging of the gap
ween the 'small-time' solution and the final
ilibrium appears to require the use of high-
ed computers. (See also W70-09572) (Knapp-
GS)
0-09571

EADY FLOW IN THE ZONE OF AERATION,
blogical Survey, Denver, Colo.; and Geological
vey, Little Rock, Ark.
W. Stallman, and J. E. Reed.
nch resume. In: Water in the Unsaturated Zone,
II, Proceedings of the Wageningen Symposium,
Netherlands, June 19-25, 1966, International
ociation of Scientific Hydrology, Publication
83, p 565-578, 1968. 14 p, 4 fig, 2 tab, 13 ref.

scriptors: *Hydraulic conductivity, *Capillary
ductivity, *Soil water movement, *Zone of
ation, Darcys law, Hydraulic gradient, Porosity,
aturated flow, Groundwater movement, Steady
, Recharge, Infilitration.
ntifiers: Soil water discharge.

draulic conductivity in the steady upward flow
ne zone of aeration can be estimated using data
the porosity and the thickness of the hydrauli-
y conductive zone above the water table. For
nward flow hydraulic conductivity is estimated
g the liquid pressure-head measured far above
water table. It seems unlikely that vertical
city in the zone of aeration can be estimated
in two orders of magnitude by use of Darcy's
with field observations of the head distribution
laboratory measurement of conductivity.
phasis in research is needed on the following:
Field applications of theories of multifluid flow;
Field measurement of velocity in the zone of
tion; (3) Listing in reports of laboratory ex-
ments all pertinent data on porous media and
ids used; (4) The relation between plant growth
ors and depth to the water table. (See also
0-09573) (Knapp-USGS)
0-09572

**TER TRANSMISSION BY EVAPORATION
D FROST ACTION AT DIFFERENT SOIL
NDITIONS IN SUCTION LYSIMETERS,**
Czeratzki.
ich resume. In: Water in the Unsaturated Zone,
II, Proceedings of the Wageningen Symposium,
Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 579-591, 1968. 13 p, 11 fig, 3 tab, 15 ref.

Descriptors: *Soil water movement, *Lysimeters, *Instrumentation, Evapotranspiration, Evaporation, Moisture tension, Moisture content, Pore pressure, Water balance, Hydrologic budget.
Identifiers: *Deep lysimeters.

Various methods used for investigating water transmission in soils in connection with problems of water recharge, evaporation and evapotranspiration are reviewed. The construction of lysimeters must be such that their water transmitting properties are similar to those occurring under natural conditions. One of the greatest difficulties in lysimeters with no water table is the establishment of water outflow under suction conditions as in a continuous soil profile. With a percolation funnel the capillary system ends at the bottom of the soil monolith so that the outflow of the percolation water takes place with zero suction. Establishment of suction conditions at least in the upper part of the root zone is possible with deep lysimeters. In shallow lysimeters the impeded water outflow leads to overmoistening of the soil monolith and consequently to unnatural conditions of water transfer. This difficulty can be eliminated by using suction lysimeters with bottoms consisting of a suction device for maintaining variable water suction. The results of tests of suction lysimeters are compared with the work of other authors and the possibilities created by this type of lysimeter for the investigation of soil-water-plant-relations are described. (See also W70-09574) (Knapp-USGS)
W70-09573

BASIN PEAT CULTURE FOR WATER ECONOMY,
Helsinki Univ. (Finland). Dept. of Agricultural Chemistry.
V. Puustjarvi.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 591-595, 1968. 5 p, 3 tab.

Descriptors: *Evaporation control, *Peat, Marshes, Mulching, Groundwater movement, Soil water movement, Evaporation, Water utilization, Soil management, Water conservation.
Identifiers: *Peat culture, Finland.

In recent years the Agricultural Chemistry Institute of Helsinki University has been attempting to develop a water saving peat culture method. The method is called peat basin culture. The surface of the soil is covered by a polyethylene film and the edges of the film are turned up to a height of 3-5 cm. Fertilized peat is placed in the basin so formed and is then soaked thoroughly with water. A water layer of 3-5 can remain at the bottom of the basin to assure an even supply of moisture to the plants. Groundwater is not necessary and it is not used when the peat layer is thin. The evaporation can be decreased further by covering the peat layer with a polyethylene film or by using plastic greenhouses. The quality of the peat used in basin culture must be suitable for this purpose. To remain in equilibrium with the groundwater the air volume of the peat must be at least 20%. The capillary rise of the water from the groundwater to the surface of the peat layer must be rapid and even. The advantages of the method: (1) There is no unnecessary loss of water or there is no leaching; (2) Pathogens cannot spread from the soil to the culture medium; (3) Growth is rapid and even; (4) It is a simple and easy method to master. (See also W70-09575) (Knapp-USGS)
W70-09574

EVAPORATION FROM BARE SOIL AND THE WAYS OF REDUCING IT,
Agrophysical Inst., Leningrad (USSR).
S. Nerpin, S. Pakshina, and N. Bondarenko.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 595-602, 1968. 8 p, 7 fig, 16 ref.

Descriptors: *Evaporation, *Soil water movement, *Evaporation control, *Mulching, Capillary action, Capillary conductivity, Diffusion, Soil conservation, Water conservation, Soil management, Hydrogen bonding, Water utilization.
Identifiers: *Capillary conductivity reduction.

Evaporation from bare soil is an unproductive process in arid and semiarid regions. It not only reduces the soil moisture content, but also results in salt accumulation in the root zone. A liquid evaporation mechanism is proposed to take into account both diffusive and film water flow, and explains the apparent deviation from Thompson's law and controlling evaporation intensity as well. Some surface active substances when applied to the surface soil layer bring about a reduction in evaporation intensity not only because they interrupt the film flow on the capillary surface, but also because they reduce the diffusive and thermo-capillary flow. The effect of non-ionic surfactants which strongly protect the soil surface from evaporation depends on the intensity of the bonds between surfactants and the soil particles. A temperature increase results in progressive transfer of surfactant molecules from the surface of the particles to bulk. In such a case protection is decreased, and at a critical of temperature, hydrogen bonds are broken and all protection is lost. The laboratory data presented confirm this conception. The critical temperature for investigated surfactants is about 60 deg C. (See also W70-09576) (Knapp-USGS)
W70-09575

RELATION BETWEEN EVAPORATION AND SOIL HYDROCONSTANTS,
Ceskoslovenska Akademie Ved, Bratislava. Inst. of Hydrology and Hydraulics.
Jan Benetin, and Julia Cervenkova.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 602-610, 1968. 9 p, 5 fig, 2 tab, 5 ref.

Descriptors: *Evaporation, *Soil water movement, *Soil physical properties, Capillary action, Saline soils, Saline water systems, Saline water, Salts, Moisture content, Diffusion, Drying.
Identifiers: Soil salinization.

Evaporation as a cause of the soil salinization process is proportional to the difference between the vapor tension of the soil air and that of the surrounding atmospheric air. As the soil vapor tension is dependent upon the soil moisture content, the affinity to liquid water to the solid soil phase affects the course of soil water evaporation. A method is given for estimating the soil water limits from the recorded course of soil sample drying. Results from experiments carried out with various soils show that the intensity of evaporation is still considerable at the low soil moisture contents and it depends remarkably upon the chemical composition of the soil. Soils saturated with K- and Na-ions evaporate more rapidly at low water contents than soils saturated with Ca-ions. The differences in evaporation decrease with increase in soil water content. Slow drying of saline soils is not due to the chemical composition of the soils, but to the small water flow moving into the surface layer. (See also W70-09577) (Knapp-USGS)
W70-09576

THE MOVEMENTS OF DIFFERENT SALT SOLUTIONS IN SOIL PROFILES,
Magyar Tudomanyos Akademia Talajtani es Agrokemiai Jutato Intezete, Budapest.
I. Szabolcs, and J. Lesztak.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium,

The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 611-621, 1968. 11 p, 6 fig, 2 tab, 11 ref.

Descriptors: *Soil water movement, *Saline water systems, *Soil structure, *Permeability, Evaporation, Soil physical properties, Soil chemical properties, Soil chemistry, Water chemistry.
Identifiers: Soil salinity-permeability relations.

Experiments were made to study the laws of capillary movement of salt solutions of different composition in soil profiles. Fore the experimental purposes 1 meter high plastic tubes, 12 cm in diameter, were filled with a chernozem soil. Using capillary wetting from the bottom, the soils were treated with 0.1 N solutions of Na, Na2 and Mg sulfate, chloride, and carbonate. In the case of capillary wetting from the bottom, the solutions' movement was significant only if free evaporation was assured. In the absence of evaporation only the lowest, about 15 cm thick soil layer came into contact with the salt solutions. No significant differences could be observed between the effects of the various salts. When the capillary movement was aided by evaporation, the movements of the various salt solutions within the soil column differed to a great extent from each other. While the solutions of Mg chloride and neutral sodium salts reached the surface of the 1 meter high soil column, the soda solution penetrated only the lowest, 15 cm thick layer. The influence of the soda solution intensely manifested itself by significantly changing the physical properites of this layer. As a result treating the soils with soda solution, the microaggregate compositon of the soil layer involved changed, the water permeability of that soil layer was practically reduced to zero, the structure factor decreased, while the dispersity increased and, as compared to the soils treated only with the solutions of neutral sodium salts, the plasticity also increased. If sodium salts capable of alkaline hydrolysis, especially soda, can be found in the soil, they exert a significant and detrimental influence on the water and salt movement which take place in the soil and on the soil's physical and water regime properties. (See also W70-09578) (Knapp-USGS)
W70-09577

ON THE PROBLEM OF SALT DIFFUSION IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
N. A. Ogilvy.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 622-628, 1968. 7 p, 8 ref.

Descriptors: *Saline water systems, *Soil water movement, *Diffusion, Mathematical studies, Equations, Diffusivity, Capillary action, Infiltration, Arid lands, Discharge (Water), Permeability, Soil properties, Convection.
Identifiers: Soil salt movement.

With small amounts of infiltration which are generally observed in arid regions in the zone of aeration an ascending salt flow counteracts a descending convection salt transfer by infiltrating water. At distance from the solid walls of the rock skeleton exceeding the mean free path of translation of particles, diffusion in free interstitial water is similar to that in large solution volumes. In bound water, translation jumps of the particles occur with different frequency. Therefore, the diffusion coefficient in bound water may greatly differ from the corresponding free water coefficient. In rocks, the solute transfer in bound water is proportional to the rock's specific surface and the thickness of the bound water film. In sands, the solutes are mainly transferred in free water, while in clays they move primarily within the bound water. The diffusion phenomena in the zone of aeration of arid regions account for the processes of carbonate cementation of this zone, for the appearance of gypsum crusts in it and also for the observed relations between occurrence of ombrophytes and the groundwater salinity. (See also W70-09579) (Knapp-USGS)
W70-09578

EFFECT OF SOIL SALINITY ON THE LOSS OF WATER FROM VEGETATED AND FALLOW SOIL,
Geological Survey, Phoenix, Ariz.
T. E. A. van Hylckama.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 635-644, 1968. 10 p, 4 fig, 4 tab, 18 ref.

Descriptors: *Evapotranspiration, *Saline water, *Phreatophytes, *Tamarisk, *Arizona, Lysimeters, Consumptive use, On-site tests, Arid lands, Water levels, Water management (Applied), Water conservation.
Identifiers: Evapotranspirimeters.

In the semiarid zone of the southwestern United States some six million hectares near washes and along rivers are covered by a dense growth of riparian or phreatophytic vegetation, consisting very often of pure stands of saltcedar (Tamarix pentandra). This vegetation, having a nearly unlimited access to water, transpires large quantities, estimated to total over 29,000 million cu km per year. In order to measure the actual rate of evapotranspiration 6 large evapotranspirometers (surface area about 80 sq m) were installed near Buckeye, Arizona in 1959 and another 5 in 1962. In 1963 the salinity of the groundwater in the older tanks had risen from an original 4 to over 200 parts per thousand. Although saltcedar is reported to tolerate and thrive on soil moisture of high salinity, the tanks were flushed out until the salinity of the effluent was back to the original. Whereas in 1963 the water use varied between 80 and 200 cu m per tank per year (depending on depth to water in the tanks), after flushing, the use increased by more than 50%. It is frequently assumed, when water use by phreatophytes is estimated, that the plants have access to water of low salinity. The data presented show that this assumption may not always be right and that the actual water losses may be less than estimated by as much as 40%. (See also W70-09580) (Knapp-USGS)
W70-09579

METHODS AND FORMULAS FOR THE DETERMINATION OF SOIL EVAPORATION AND SOIL MOISTURE CONTENT FROM HYDROMETEOROLGICAL DATA,
Hydraulic Research Inst., Bratislava (Czechoslovakia).O
Artur Sermer.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 644-650, 1968. 7 p, 7 fig.

Descriptors: *Soil water movement, *Evapotranspiration, Lysimeters, Hydrology, Soil moisture, Water balance, Infiltration, Laboratory tests.
Identifiers: Czechoslovakia.

Soil water movement and evapotranspiration are studied at Ziharec, Czechoslovakia by using lysimeters, evaporimeters, and moisture balance studies. Results of recent studies are presented in the forms of equations and graphs, and methods of conserving water are discussed. (See also W70-09581) (Knapp-USGS)
W70-09580

VERTICAL DISTRIBUTION OF EXCHANGEABLE CATIONS IN SOILS OF ARID ZONES AS AN INDICATION TO THE DEPTH OF WATER INFILTRATION,
Egyptian Desert Inst., Cairo.
Ahmad Amin Hassan.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 650-658. 9 p, 4 fig, 2 tab, 9 ref.

Descriptors: *Soil water movement, *Leaching, *Cation exchange, *Soil chemistry, *New Mexico, Water chemistry, Solutes, Aqueous solutions, Ion exchange, Infiltration, Arid lands, Evaporation, Chemical precipitation, Saline soils.
Identifiers: Socorro (N M).

The climate, physiography, geology, and soils of the Socorro area, New Mexico are described, and the distribution of exchangeable cations in the soils is discussed. Soil samples were collected from 75 profiles and ammonium acetate was used to extract exchangeable cations. The amount of exchangeable calcium and magnesium ions tends generally to decrease until the lower B or C horizons are reached; then there is usually an increase in the amount of these ions. The amount of exchangeable sodium ion generally increases with depth until the lower B or C horizons, then it decreases. Potassium showed a random distribution in most of the soils. The abrupt change in distribution of these exchangeable cations coincides with the lime accumulation zone of the soil. Exchange distribution indices for soils show that much of the exchangeable Ca, Mg, and Na moving downward through the soil were retained by the B and the C horizon. It was assumed that the soil profile has been developed from a relatively uniform material. From the exchange distribution indices, it may be justified to conclude that little infiltration of water or none in the lower layers of these soils take place. A negligible penetration of water into the soil, followed by evaporation of the moisture back into the atmosphere, prevents the possibility of through leaching of the surface soil. (See also W70-09582) (Knapp-USGS)
W70-09581

METHODS AND DEVICES FOR MEASURING MOISTURE, EVAPORATION AND AVAILABLE WET RATIO OF SOIL BASED ON THE ANALYSIS OF ITS HEAT REGIME,
Committee for the I.H.D., Moscow (USSR).
A. F. Chudnovsky.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 658-669, 1968. 12 p, 3 fig.

Descriptors: *Soil moisture, *Evaporation, *Moisture content, *Instrumentation, *Heat budget, Soil water movement, Soil physical properties, Soil temperature, Computers, Equations.
Identifiers: *Soil heat regime.

A discussion is given of the theoretical aspects of the determination of soil-moisture content from the thermal properties of the medium. The possibilities of application are reviewed. An evaluation is made of the use of the energy balance approach for determining evaporation from bare soils. A plan is given for automatic equipment connected to a computer. (See also W70-09583) (Knapp-USGS)
W70-09582

WATER MOVEMENT AND USE OF PEAT SOILS IN LOWLAND SWAMPS OF THE U.S.S.R.,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
K. Shishkov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 682-687, 1968. 6 p, 1 fig, 5 tab.

Descriptors: *Soil water movement, *Peat, *Swamps, Infiltration, Tensiometers, Soil management, Water conservation, Water yield, Diffusion, Water storage.

entifiers: *USSR.

ater penetration rates in the peat soils fluctuate om 0.05 m/hr. to 0.15 m/hr. The water penetra- on rate during the first hour ranges from 0.007 /hr to 0.49 m/hr. Steady water flow penetration te is established as 0.02 to 14.4 m/hr. The inimum height of capillary rise in peat soils is 47 55 cm and the maximum rise is from 63 to 78 n. Tensiometers with air vacuummeter were used r water vapor condensation study in peat soils. otal vapor condensation at 20 cm during 56 days as 8.7 mm/sq cm and at 30 cm 10.9 mm/sq cm. epth of root expansion depends on plant species d drainage norms. The roots of cabbage plants netrate 100 cm into the soil and alfalfa roots 104 n with fluctuations of water table from 50 cm to 4 cm. Most of the cabbage plants roots are found the layer 0 to 20 cm (73%). Moisture depression fecting plant growth depends on soil properties, nt species and weather during vegetative riods. On river silt loam peat the depression for dder beet, sugar beet, and maize begins at a water rage level about 23 to 29%: for carrot, red-beet, bbage, and perennial grass on peat moors, it gins at a water storage level about 17 to 29%. ee also W70-09584) (Knapp-USGS)
70-09583

E OF SOIL MOISTURE AND GROUND- ATER BY COTTON PLANTS UNDER SPRIN- LING IRRIGATION IN ARID ZONES,
l-Union Scientific Research Inst. of drotechnics and Reclamation, Moscow (USSR).
V. Preobrazhenskaya.
nch resume. In: Water in the Unsaturated Zone, l II, Proceedings of the Wageningen Symposium, e Netherlands, June 19-25, 1966, International sociation of Scientific Hydrology, Publication 83, p 688-693, 1968. 6 p, 3 fig, 4 tab, 5 ref.

scriptors: *Consumptive use, *Irrigation water, otton, Arid lands, Lysimeters, Evapotranspira- n, Leaching, Sprinkler irrigation, Irrigation prac- es, Water conservation, Water management pplied).
ntifiers: Cotton irrigation.

rinkling irrigation of cotton is useful in arid es. It is most efficient when there is a shllow undwater table--of fresh or only slightly neralized water--at the beginning of the vegeta- n period. This condition can be produced by au- n-winter waterings, designed to produce such rage and also to flush saline patches of the soil. ld tests, using lysimeters 4 m deep showed that r 3000 or 3500 cu m/ha of winter irrigation for harge and flushing, the water table came up to ut 1.3 or 1.5 m: sprinkling irrigation in the mmer, using 1500 to 2000 cu m/ha in 3 or 4 terings then produced high cotton yields (30 to centners per ha), and the water table sank to 3.5 4.0 m. The total water consumption with this hnique was 6500 to 7500 cu m/ha, somewhat ller than when the cotton was irrigated only in growing season by furrow irrigation, but the sfaction of part of the water need by autumn or ter application releases considerable resources water for irrigation of additional areas in mmer time. (See also W70-09585) (Knapp-GS)
0-09584

TER MOVEMENT AND ITS UTILIZATION PLANTS UNDER THE DEEP WATER DRAGE IN SOIL BY USING OFF-SEASON RIGATION,
-Union Scientific and Research Inst. of drotechnics and Reclamation, Moscow (USSR).
G. Grammaticati.
nch resume. In: Water in the Unsaturated Zone, II, Proceedings of the Wageningen Symposium, Netherlands, June 19-25, 1966, International ociation of Scientific Hydrology, Publication 83, p 694-704, 1968. 11 p, 4 fig, 7 tab, 4 ref.

criptors: *Soil-water-plant relationships, *Soil sture, *Soil water movement, *Evapotranspiration, Drying, Evaporation, Consumptive use, Irrigation water, Water conservation, Irrigation practices.
Identifiers: Deep soil water storage.

To determine the water uptake by roots from the deep soil layers, the root penetration and soil moisture movement within and beyond the root zone and on the plots without plants were studied. The depth of root penetration of most field crops was more than 1 metre, and that of sunflower and winter wheat reached 270-300 cm when the soil was deeply irrigated. A few plant roots penetrate into the deep soil layers. However, intense growth and high physiological activity of the roots make it possible for the plants to utilize a great amount of moisture from the deep soil layers. Physiological activity of the root system in the deep soil layers consists not only of moisture uptake from the soil, but also of water transfer to the upper tier which is located in dry soils. Evaporation from bare soil is intense in the upper soil layers, gradually decreases with depth, and finally dies away at a depth of 70 to 80 cm. Therefore, in deeper soil layers the process of biological desiccation takes place if the roots penetrate into these layers. The zone of 'the principal biological desiccation' lies deeper, and its depth depends on the root penetration and may reach to 280 or 300 cm. The uptake from the zone of the principal biological desiccation reaches 1600 cubic metre per ha, equal to 45% of consumptive use during the whole vegetative season. The stable harvest obtained by using deep off-season irrigation may be explained by the presence of water in the principal biological zone where there is no loss of water by evaporation, but where stored water serves as a reserve to protect the plants from drought. (See also W70-09586) (Knapp-USGS)
W70-09585

WATER REGIME OF THE SOIL AS AFFECTED BY VEGETATION,
Research Inst. of Agricultural Economics, Budapest (Hungary).
K. Kallay.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 704-711, 1968. 8 p, 4 tab, 10 ref.

Descriptors: *Soil-water-plant relationships, *Soil moisture, *Evaporation, *Evapotranspiration, Water storage, Soil water movement, Consumptive use, Seepage, Heat budget, Water balance.
Identifiers: Hungary, Soil water-groundwater relationships.

The effect of winter wheat, maize and lucerne on the water regime of the soil in the semiarid climate of central and eastern Hungary, on deep soil with groundwater level below 300 cm was studied. During three winters, on average, 72% of the precipitation was stored in deeply loosened, uncropped soil, 66% under winter wheat, 55% under lucerne, and 26% under natural grassland. During the vegetation period, foliage retains part of the precipitation, lucerne retained 2-4 mm precipitation, but immediately after the harvest of hay only 1 mm was retained. In August 1938, 220 mm of precipitation wetted well cultivated wheat stubble to a depth of 60-70 cm, while under both maize and sugar beet the depth was 30 cm, and under lucerne, only 20 cm. Transpiration during the phase of rapid development of thirty to forty days, represents 70-85% of the annual absolute water consumption. In this critical period the moisture reserve previously stored by the soil may be exhausted, and damage by drought may occur. The losses from the water reserve are increased by evaporation from the soil. Measurements of the absolute water consumption of several wheat varieties, and of lucerne, were made. The absolute quantity of water transpired on soils of good and poor nutritional status, with great differences in crop yields, was the same. On the basis of these investigations conducted in Hungary some measure to be taken in this field to obtain higher crop yields are suggested. (See also W70-09587) (Knapp-USGS)
W70-09586

POTENTIAL EVAPOTRANSPIRATION OF MAIZE (FRENCH),
Institute of Irrigation Research, Prague (Czechoslovakia).
Miloslav Pycha.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 711-723, 1968. 13 p, 2 fig, 9 tab, 9 ref.

Descriptors: *Soil-water-plant relationships, *Supplemental irrigation, *Corn (Field), Water balance, Evapotranspiration, Humidity, Consumptive use, Frequency analysis, Demonstration watershed, Experimental farms.
Identifiers: Czechoslovakia, Corn irrigation.

With accurate data more economical supplemental irrigation systems can be designed. One of the required data is the water consumption of various crops. Investigations concerning the consumption of maize started in Czechoslovakia in 1955. Consumption was determined under natural conditions from water balance studies. Optimum conditions of water supply were obtained by irrigation. Consumption was calculated weekly, using soil moisture determinations at a depth of 100 cm. A correlation between the yearly consumption and the saturation deficit of the air was determined. The course of consumption during growth was characterized by a biological curve for different stages of growth. The coefficients of this curve were determined from the weekly data obtained with the water balance and the sum of daily values of the saturation deficit during the period under consideration. These data were used to calculate the water consumption of maize during the period from 1932-1962. The results were used in a frequency analysis for the determination of water consumption of maize. (See also W70-09588) (Knapp-USGS)
W70-09587

THE EXTRACTION OF SOIL MOISTURE BY PLANTS UNDER DRY LIMIT CONDITIONS,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
O. Klausing.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 724-729, 1968. 6 p, 1 tab, 10 ref.

Descriptors: *Soil-water-plant relationships, *Drought resistance, Crop response, Potatoes, Moisture stress, Moisture content, Evapotranspiration, Physiological ecology, Plant physiology, Drought tolerance, Moisture deficit, Water shortage, Capillary water.
Identifiers: Germany.

During a dry summer period in Germany, potato plants extracted water from soil beyond 15 atm. suction. These measurements were followed by laboratory studies on soil moisture and plant growth under limiting conditions of incipient drying and permanent wilting. The result is a new thermodynamic treatment of soil moisture in respect of capillary water and film water, and their importance for specifying availability. The term 'available water' has to be defined with the same thermodynamic differentiation on the basis of plant water relations studies in laboratory and in the field. These ecophysiological investigations suggest that the constitutional drought resistance of the higher plants is conditioned by relative independence of capillary forces and osmotic forces in the cellular plant tissue and in the whole plant body. Therefore the plant constitution (especially its drought resistance) has to be considered in all questions about the extraction of soil moisture by plants under dry limit conditions. (See also W70-09589) (Knapp-USGS)
W70-09588

EVAPOTRANSPIRATION OF PLANTS AND FLUCTUATION OF THE GROUNDWATER TABLE,
State Inst. of Hydrology and Meteorology, Warsaw (Poland). Water Physics Div.
Jerzy Jaworski.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 730-739, 1968. 10 p, 10 fig, 1 tab, 17 ref.

Descriptors: *Soil-water-plant relationships, *Drought resistance, *Capillary water, Moisture tension, Phreatophytes, Crop response, Moisture content, Evapotranspiration, Plant physiology, Physiological ecology, Drought tolerance, Water shortage, Consumptive use, Water level fluctuations.
Identifiers: *Soil water-groundwater relationships, Poland.

Evapotranspiration by plants--in particular by woody plants--is quite intense in the growing period (725 mm). With a considerable precipitation deficit, the water must come from the zone of the capillary rise of soil moisture. The moisture uptake from this zone during the evapotranspiration process is reflected in short-term daily fluctuations of the groundwater level. The fluctuation range depends on the kind of vegetation, the intensity of transpiration, and whether roots are deep or shallow. The groundwater fluctuations influence the side inflow of groundwater from adjacent areas with less intense transpiration. Considerable daily losses of soil moisture by evapotranspiration in a rainless period cause a continuous decline of the average groundwater level. For each 1 mm of daily evapotranspiration from poplars there was a daytime fall of the groundwater level of about 2 cm. This daily fluctuation sometimes reached 17 cm, but under a meadow or potatoes the fluctuations were very slight, or they did not occur at all. The daily fluctuation is less intense on a cloudy day, probably because of smaller evapotranspiration intensity. Studies of the source of water for plants--in particular, for deeply rooted plants--must not be restricted to the unsaturated zone only. They may draw on groundwater. (See also W70-09590) (Knapp-USGS)
W70-09589

THE INFLUENCE OF VARIOUS AGRICULTURAL PRACTICES ON SOIL WATER AND IN THE ZONE OF AERATION OF CHERNOZEMS (FRENCH),
Dilko Dilkov.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 739-742, 1968. 4 p, 2 tab.

Descriptors: *Soil-water-plant relationships, *Chernozems, Soil water movement, Moisture content, Field capacity, Hydraulic conductivity, Consumptive use, Clays, Loess, Zone of aeration, Corn (Field), Alfalfa.
Identifiers: Bulgaria.

Investigations on soil moisture in the unsaturated zone of chernozems in the Northern part of Bulgaria showed interesting regularities due to the influence of various crops and the hydraulic conductivity of the subsoil. The depth to which the soil moisture is affected depends on the granular composition of the soil. In typical loess soils the size fraction from 0.05-0.01 mm predominated. An abrupt change in soil water movement was observed when the soil moisture content was at 65-70% of field capacity. In this region the crop also affected the hydrological situation in the unsaturated zone, with a rooting depth from 0.5 to 2.0 m to a layer in which more clayey material was present. In this layer the moisture content was about 85-90% of field capacity. Large differences in the soil moisture in the unsaturated zone were observed with the various crops. Alfalfa, grown during 5-6 years on the same spot, showed the largest effect on the recharge of the subsoil. This crop used all the water which could be taken up by the roots to a depth of 608 m. A similar result was obtained with maize, and to a much shallower depth with other crops. The various crops affected the soil moisture in the unsaturated zone and also the vertical movements. (See also W70-09591) (Knapp-USGS)
W70-09590

FIRST MEASUREMENTS OF SOIL WATER EVAPORATION WITH THE AID OF LYSIMETERS IN CZECHOSLOVAKIA (FRENCH),
Institute for Protection of Monuments and Nature, Bratislava (Czechoslovakia).
Stefan Fekete.
In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 742-748, 1968. 7 p, 4 fig, 1 tab, 7 ref.

Descriptors: *Evaporation, *Evapotranspiration, Water balance, Lysimeters, Surveys, Instrumentation, Mapping, On-site tests.
Identifiers: *Czechoslovakia.

Research on soil evaporation in Czechoslovakia is described and the first map of soil evaporation distribution in the eastern part of the Czechoslovak Socialist Republic (Slovakia) is presented. A summary of methods for establishing soil evaporation used in Czechoslovakia is given and original Czechoslovak literature dealing with this problem is listed. (See also W70-09568) (Knapp-USGS)
W70-09592

DETERMINATION OF STORAGE COEFFICIENTS FROM OBSERVATION OF GROUNDWATER LEVELS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
L. F. Ernst.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 966-990, 1968. 25 p, 15 fig, 1 tab, 13 ref, append.

Descriptors: *Storage coefficient, *Groundwater movement, *Water level fluctuations, *Soil water movement, *Saturated flow, Storage capacity, Analytical techniques, Hydrogeology, Water balance, Hydrologic budget.
Identifiers: Groundwater level fluctuations.

Particular solutions of the basic differential equation for non-steady groundwater flow between parallel drainage channels show to what degree the fluctuations of the groundwater table depend on the storage coefficient. In areas with not too small spacings of the drainage channels, the fluctuations of the groundwater table can be considered with a good approximation as being directly proportional to the inflow (excess precipitation or capillary rise) through the upper boundary of the considered area and as inversely proportional to the storage coefficient. In such areas the knowledge of maximum and minimum groundwater levels (winter and summer) and of the corresponding values of excess precipitation and capillary rise is sufficient for a determination of the storage coefficient. From measurements of the relation between moisture suction and moisture content in sandy soils it is known that at the same moisture suction a smaller grain size involves a smaller air content and therefore also a smaller storage coefficient. This agrees with the variations in the groundwater level fluctuation as shown in some maps: small fluctuations in areas with coarse sandy soils, large fluctuations in areas with fine sandy soils. (See also W70-09709 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09708

UNSATURATED SOIL MOISTURE CONDITIONS STUDIED FROM FIELD OBSERVATIONS,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. C. Visser.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 952-966, 1968. 15 p, 16 fig, 1 tab, 3 ref.

Descriptors: *Unsaturated flow, *Soil water movement, *Mathematical studies, *Analytical techniques, Hydrogeology, Water balance, Hydrologic budget, Runoff, Infiltration, Evapotranspiration, Storage capacity, Soil moisture.
Identifiers: Groundwater movement calculation, Soil water movement calculation, Graphical methods.

The changes in the depth of the groundwater table are the result of the integrated effects of rain discharge, evaporation and storage. It is possible to reconstruct the values for the quantity of discharge real evaporation and storage if rainfall and groundwater depth are given. This can be carried out along lines of fitting the data to physical formulae or along lines of graphical analyses. The graphical method is accessible to anyone without need of complicated mathematical or laboratory equipment. Methods for its use are given and discussed. (See also W70-09710 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09709

TOP WATER AND INTERSOIL RUNOFF OF SNOWMELT AND RAINFALL WATER,
Hydrometeorological Research Center, Moscow (USSR).
A. I. Subbotin.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 946-951, 1968. 6 p, 1 fig, 9 ref.

Descriptors: *Soil water movement, *Saturated flow, *Subsurface runoff, Snowmelt, Rainfall, Rainfall intensity, Percolating water, Infiltration, Recharge.
Identifiers: *Top water (Saturated soil water movement).

Top water, a temporary saturated soil water zone and intersoil runoff appear as an effect of heavy rainfall and snowmelt. Top waters usually arise in podzol soil; however, in spring they can arise also in homogeneous soil (chernoziom, loess), since at this time an impermeable stratum of still frozen soil may occur under the thawed-out layer. Field and laboratory research showed the important role of top water and intersoil runoff in the aeration zone and in the runoff originating from rainfall and snowmelt. (See also W70-09711 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09710

VARIATIONS IN SOIL MOISTURE STORAGE DURING THE WINTER HALF YEAR,
Technical Univ. of Building and Transport Engineering, Budapest (Hungary). Dept. of Water Resources Development.
L. Szabo.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 936-946, 1968. 11 p, 4 fig, 8 ref.

Descriptors: *Soil moisture, *Storage capacity, *Winter, *Soil physical properties, *Frozen soil, Freezing, Wetting, Drying, Mathematical studies, Infiltration, Percolation, Water storage, Frost.
Identifiers: Soil moisture storage (Seasonal).

moisture regime of the top soil is decisively in-
ced by weather in addition to physical and
tural properties of the soil, nature of vegeta-
cover, and the depth of the groundwater table.
change in the moisture content of the top soil
e winter half-year were related to some charac-
ic soil types. The instantaneous moisture con-
of the top soil subjected to water-content
ges (soaking, drying, freezing) can be deter-
d for a given point of time in an indirect way
ing formulae based on precipitation conditons
r loading) prevailing in the preceding period.
also W70-09712 and W70-09568 thru W70-
2) (Knapp-USGS)
09711

LUATION OF POROSITY OF DRAINING
USING DISCHARGE HYDROGRAPHS
NCH),
Coll. of Agronomical Science, Gembloux
ium).
e, and S. Gaspar.
Water in the Unsaturated Zone, Vol II,
edings of the Wageningen Symposium, The
rlands, June 19-25, 1966, International As-
ion of Scientific Hydrology, Publication No
923-936, 1968. 14 p, 8 fig, 6 tab, 11 ref.

iptors: *Storage capacity, *Drainage, *Soil
movement, *Saturated flow, *Unsaturated
Storage coefficient, Drainage engineering,
levels, Water table, Mathematical studies,
Soils, Porosity, Permeability.
fiers: Drainage discharge (Soil water).

arge curves of drains are used to compute the
e capacity of soils under natural conditions.
rying part of the curve, when the effect of
itation has stopped, and the hydrological
balance are considered. The field tests were
rmed on clay soils with low permeability and
my soils with moderate permeability. An im-
able layer was at a short distance from the
. The storage capacity was constant as long as
ight of the water table remains more than 18
ove the drains. The values obtained in this
re clearly smaller than the values obtained
the difference between saturation and field
ity. (See also W70-09713 and W70-09568
70-09592) (Knapp-USGS)
09712

CT OF CAPILLARITY ON DISCHARGE
ATER IN PERMEABLE AQUIFERS CON-
) BY ROCKS WITH SMALL IN-
TICES (FRENCH),
imary bibliographic entry see Field 02F.
09713

SPIRATION OF SUGAR BEET,
rch Inst. of Irrigation Management,
ava (Czechoslovakia).
imary bibliographic entry see Field 02D.
09714

ISOTHERMAL MOISTURE TRANSFER IN
TURATED SOILS,
Nerpin, and A. M. Globus.
n resume. In: Water in the Unsaturated Zone,
Proceedings of the Wageningen Symposium,
etherlands, June 19-25, 1966, International
ation of Scientific Hydrology, Publication
, p 761-772, 1968. 12 p, 5 fig, 1 tab, 21 ref.

ptors: *Soil water movement, *Diffusion,
ransfer, Energy transfer, Osmosis, Freezing,
ary action, Heat transfer, Convection,
ration, Thermodynamic behavior, Soil
s, Soil chemistry, Temperature.
iers: *Thermal moisture transfer.

ist soils where temperature gradients exist,
llowing mechanisms of thermal moisture
r can be active: (1) Vapor convection; (2)
diffusion; (3) Vapor thermal slipping; (4) Thermo-capillary flow; (5) Thermo-capillary film flow; (6) Liquid transfer induced by changing volume of entrapped gas due to the change of temperature; (7) Thermo-selfdiffusion of water; (8) Thermo-osmosis of liquid; (9) Combined vapor-liquid transfer including the interaction between liquid and vapor within pores of a soil. When the soil freezes another mechanism is induced by the liquid-to-ice phase transition and by the changes in the moisture potential of the system. When investigating thermal moisture transfer it is important first of all to estimate the relative importance of vapor and liquid transient transfers because this determines the magnitude of related heat flow, the transfer of dissolved matter, and the methods of regulating thermal moisture transfer. (See also W70-09716 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09715

INFLUENCE OF FREEZING AND THAWING OUT PROCESSES ON MIGRATION AND SOIL MOISTURE CONTENT IN THE UPPER LAYERS OF THE UNSATURATED ZONE,
Hydrometeorological Research Center, Moscow (USSR).
L. A. Razoumova.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 772-780, 1968. 9 p, 2 fig, 2 tab, 10 ref.

Descriptors: *Soil water movement, *Freezing, Capillary action, Capillary water, Percolation, Diffusion, Temperature, Moisture content, Moisture tension, Unsaturated flow.
Identifiers: Soil water movement (Freezing).

Soil samples were chilled from above to study the movement of water under freezing conditons. Moisture moved to the freezing front until the moisture content in the unfrozen source zone reached about 20%, near the moisture tension of capillary bond rupture. When the source zone was connected to a supply of water simulating a water table, moisture moved into the freezing zone until moisture content exceeded 103% of the thawed saturation value. (See also W70-09717 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09716

MOVEMENT OF MOISTURE AS A LIQUID AND VAPOUR IN SOILS OF SEMI-DESERTS,
Akademiya Nauk SSSR, Moscow. Pochvennyi Institut.
M. M. Abramova.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 781-789, 1968. 9 p, 2 fig, 7 tab, 9 ref.

Descriptors: *Soil water movement, *Mass transfer, *Diffusion, *Water vapor, *Drying, Condensation, Evaporation, Water circulation, Energy gradient, Energy transfer, Solutes, Aqueous solutions.
Identifiers: Water vapor transfer, Soil water vapor, Temperature gradient.

During evaporation from wetted soil, liquid moisture moves towards the evaporating layer. As this movement proceeds there is a partial return of moisture as vapor into the deeper layers. The direction of this movement is opposite to the temperature gradient. There is a condensation of this moisture in these cooler layers, and liquid moisture again starts moving to the evaporation surface. Such a circulation of moisture is accompanied by a movement of salts to the surface layers (if they are present in the soil solution). This leads to a 'desalting' of the soil in the condensation zone. The thickness of the condensation zone is determined by the diurnal amplitude of soil temperature. 'Seasonal' vapor movement due to the temperature gradient proceeds in the whole of the soil strata, possibly up to the layer with a constant temperature. The downward transfer of vapor in summer proceed until the wilting point is achieved. The latter is the lower limit of soil moisture content in all cases, excluding the surface layer, even if the temperature gradient is operative. The drying of soil by roots to the lower limit wilting point results in vapor unsaturation of soil air. This phenomenon gives rise to vapor transfer towards this dry zone, independent of the direction of the temperature gradient. Plants in semideserts may grow for a long time after all the available moisture in the root zone has been exhausted. Apparently plants are supplied with moisture which has been transferred into the drying zone as vapor and became liquid. The existence of such a vapor transfer, independent of the direction of the temperature gradient, was demonstrated by experiments. (See also W70-09718 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09717

SOIL MOISTURE DISTRIBUTION FUNCTION IN NON-ISOTHERMIC CONDITIONS,
Ceskoslovenska Akademie Ved, Bratislava. Inst. of Hydrology and Hydraulics.
Julius Sutor.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 790-800, 1968. 11 p, 8 fig, 19 ref.

Descriptors: *Soil water movement, *Diffusion, Energy transfer, Mass transfer, Percolation, Convection, Capillary action, Laboratory tests, Permeameters, Soil physical properties.
Identifiers: Temperature gradients, Thermal soil moisture distribution function.

In order to evaluate the influence of daily and seasonal temperature fluctuations on the movement of soil water, it is necessary to know the physical quantities describing the quantitative and qualitative influence of temperature gradients upon moisture movement. The influence of the temperature gradient upon the movement of soil profile moisture, in addition to other quantities, can be expressed using the experimentally determined moisture distribution function along the applied temperature gradient. To obtain this function clay soil was chosen and an experimental closed system method was used. The curve of moisture distribution in a soil sample assumed characteristic symmetrical shapes. The mathematical analysis of these results showed that for a closed systems the curve of moisture distribution along the applied temperature gradient could be expressed within experimental error by a cubic equation. The choice of this function was verified by comparing quantitative transfer indicators of experimentally obtained values with those calculated from the function. (See also W70-09719 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09718

RELATIONSHIP BETWEEN INFILTRATION AND GROUNDWATER HOUSEHOLD,
National Water Authority, Budapest (Hungary).
G. Kovacs.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 801-809, 1968. 9 p, 4 fig.

Descriptors: *Recharge, *Groundwater movement, *Soil water movement, Flow, Saturated flow, Unsaturated flow, Capillary action, Mathematical studies, Darcys law, Permeability, Infiltration, Hydrologic budget, Water table, Water levels.
Identifiers: Soil water-groundwater relationships.

In the unsaturated layer overlying the groundwater table water movement is influenced by gravity and adhesion. Effects of these two processes are added together concerning the groundwater space. The infiltrating recharge and water loss by evaporation

are related to the depth of the groundwater table. The difference of these two effects is determined by the characteristic curve of the groundwater regime as a function of the average depth of the groundwater. Because the difference is equal to the sum of all other effects, the water regime of the groundwater space can also be characterized by the average depth. A relationship can be found between the depth of the groundwater table and groundwater flow. Salinization of soils can also be linked to the groundwater regime. There are some hydraulic and soil science observations which justify the method described, but it is necessary to collect more data to characterize the processes investigated. (See also W70-09720 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09719

THE METHOD OF GROUNDWATER RECHARGE EVALUATION IN SAND DESERT BY INVESTIGATION OF MOISTURE EXCHANGE IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. N. Chubarov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 809-822, 1968. 14 p, 2 fig, 4 tab.

Descriptors: *Recharge, *Soil water movement, *Water vapor, Condensation, Evaporation, Diffusion, Arid lands, Sands, Moisture content, Convection, Hymidity, Moisture tension.
Identifiers: Soil water-groundwater relationships.

Study of the moisture content distribution through depth in the zone of aeration in small areas of sands covered with vegetation in the desert showed that this distribution is, even at great soil thicknesses (down to 40 m), a function of the potential of the gravitation field and the capillary potential. According to theoretical and experimental data, relationships are determined by which the moisture content and soil moisture conductivity coefficient respectively may be calculated. The relationships determined allow a series of moisture content curves to be calculated by which the direction and value of moisture flow in the zone of aeration may be determined. Comparison of a moisture curve obtained for small areas of barkhan sands showed that groundwater is recharged by atmospheric moisture at a rate of 10-20 mm per year. Supposition of the 'critical' moisture contents on the curve shows that the groundwater evaporation at the expense of liquid transportation under the conditions of sand deserts cannot occur at depths of more than 3 meters to the groundwater. Absence of the groundwater distribution elements at depths of more than 12-14 m (besides the diffusion process of 'underground' evaporation) accounts for the fact that the groundwater in the desert, as a rule, occurs at more 'critical' depths (more than 14 m) and is alinized to a smaller degree. (See also W70-09721 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09720

THE REGULARITIES OF GROUNDWATER EVAPORATION IN IRRIGATION LANDS OF THE ARID ZONE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02D.
W70-09721

THE TYPE SECTIONS OF ROCK MOISTURE IN THE ZONE OF AERATION AND ESTIMATION OF INFILTRATION VALUES,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
V. S. Markelova, N. A. Ogilvy, and V. N. Chubarov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 827-840, 1968. 14 p, 6 fig, 15 ref.

Descriptors: *Infiltration, *Recharge, *Soil moisture, Soil water movement, Groundwater movement, Mathematical studies, Percolation, Surveys, Permeability, Moisture content, Field capacity, Porosity, Capillary water, Model studies, Mathematical models.
Identifiers: *Soil water-groundwater relationships.

If the zone of aeration is very thick, 3 subzones are distinquished in it having different characters of rock moisture content. A subzone in which the rock moisture content varies with depth as well as with time is situated at the top. With depth, moisture fluctuations fade and the upper subzone turns into that of quasi-stationary moisture. The latter in turn is replaced by the capillary fringe of groundwater. If the thickness of the zone of aeration is small, the middle subzone of quasi-stationary rock moisture may disappear and the capillary fringe will come into contact with the upper subzone of variable moisture or reach the ground surface. In uniform rocks, the moisture content in the middle subzone is constant and depends on the lithological composition of the rocks and infiltration rate. In heterogeneous rocks, each lithologically different layer has its own moisture content which corresponds to the infiltration rate under the given conditions. The infiltration rate is related to the natural rock moisture content and mximum moisture capacity by an exponential function. The relationships established allow the infiltration rate to be estimated by determining the rock moisture content in the subzone of quasi-stationary moisture. Furthermore, the infiltration rate may be determined using the water reserves in the upper soil layer. Using the data on these water reserves found in aqroclimatic reference books, average infiltration values were calculated for different regions of the European part of the USSR. Infiltration varies from 100 to 20 mm per year from north to south and agrees with the determinations made by Kudelin using river runoff analyses. (See also W70-09568 thru W70-09592) (Knapp-USGS)
W70-09722

INFILTRATION AS A FACTOR AFFECTING RUNOFF COMPUTATIONS,
Prague Agricultural Univ. (Czechoslovakia).
Jan Dvorak, and Jaromir Nemec.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 840-845, 1968. 6 p, 1 fig, 2 tab, 11 ref.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Runoff forecasting, Flood forecasting, Mathematical models, Synthetic hydrology, Permeability, Duration curves, Rainfall intensity, Soil water movement.
Identifiers: Czechoslovakia.

Analysis of infiltration is used by hydrologists for the computation of runoff. On small elementary runoff plots infiltration curves are derived. The influence of soil type, slope and rain intensity on parameters of such a curve are expressed mathematically and discussed. From data of a small experimental watershed, infiltration characteristics are derived, and the influence of rain intensity on the infiltration index is ascertained. (See also W70-09724 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09723

AN ESTIMATION OF MOISTURE DYNAMICS IN THE ZONE OF AERATION AND GROUNDWATER RECHARGE BY THE HEAT-MOISTURE TRANSFER,
Akademiya Nauk URSR, Kiev. Instytut Geologichnykh Nauk.
V. J. Ljalko.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 845-851, 1968. 7 p.

Descriptors: *Soil water movement, *Heat flow, *Convection, Water vapor, Hydrographs, Lysimeters, Diffusion, Energy transfer, Mass transfer, Humidity, Recharge.
Identifiers: Thermal gradients, Ukraine.

A discussion of the heat-moisture transfer theory given in its application for the calculation of groundwater recharge. The estimates calculated by this method for the Askania-Nova, Czechoslovak are compared with measurements obtained from the underground hydrograph and with results obtained from lysimeters. The difference between the three independent methods is less of variou questions related to water economy. (See also W70-09725 and W70-09568 and W70-09592) (Knapp-USGS)
W70-09724

USE OF THE HYDRO-INTEGRATOR FOR STUDYING THE FIRST STAGE OF FILTRATION FROM IRRIGATION CANALS,
All-Union Scientific Research Institute of Hydrotechnics and Reclamation, Moscow (USSR).
M. G. Kaltagova, and V. N. Korenev.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 865-874, 1968. 10 p, 4 fig, 5 ref.

Descriptors: *Canal seepage, *Infiltration, *Hydraulic models, Equations, Soil water movement, Percolation, Model studies, Groundwater movement, Flow, Porous media.
Identifiers: USSR.

The majority of irrigation canals are canals of periodical action, and for such canals water loss at the first stage of filtration and correct determination of filtration contours are of great importance. The use of a differential equation of infiltration to solve canal seepage problems is discussed. A hydraulic model (the hydro-integrator) was constructed to study seepage and infiltration problems. The All-Union Institute of Hydraulic Engineering and Melioration has carried out investigations of the first stage of filtration for canals varying in size and running in homogeneous, non-connected isotropic soil conditions. The filtration contour lines do not depend on permeability and water sorption factors of the soil. Changing of the latter will accelerate or slow down movement of the infiltration front. The canal width on the bottom has no effect on the value and form of lateral spreading, this being dependent on the depth of water filling the canal and on the disposition of the groundwater level. (See also W70-09726 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09725

FORMATION OF INFILTRATION FLOW FROM CANAL UNDER DEEP OCCURRENCE OF GROUNDWATER,
All-Union Scientific and Research Institute of Hydrotechnics and Reclamation, Moscow (USSR).
S. A. Guirshkan, I. P. Mochalov, and V. E. Rayn
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 874-879, 1968. 6 p, 2 fig.

Descriptors: *Unsaturated flow, *Canal seepage, Infiltration, On-site tests, Capillary water, Groundwater movement, Soil water movement, Saturated flow, Pore pressure, Nuclear moisture meters.
Identifiers: USSR.

Infiltration from a canal into a thick soil stratum above deep groundwater is discussed.

erogenous flow, the main moving phases are er and pore air. The pore air is displaced by in- ation water until the infiltration zone is formed the movement becomes stabilized. To study physical picture of infiltration from the canal l, experiments were carried out on a test soil lodnaya Steppe, Uzbekistan) using systematic ervation of infiltration from experimental als. Groundwater was at a depth of 20 m in n of the loess type, interlaid with sandy soils of erent density. Infiltration rate, formation of the tration zone before and after contacting the llary edge of the groundwater, saturation of the ous space with water, and distribution of pres- in the infiltration flow zone were observed. A ron moisture meter, designed at the All-Union ntific Research Institute, Hydraulic Engineer- and Melioration, named after Kostiakov, was for this purpose. As the moistening front es through the soil, saturation increases enly, which confirms experimentally the ex- ce of a saturation jump at the border of dis- ement of the porous air by infiltration water. also W70-09727 and W70-09568 thru W70- 92) (Knapp-USGS)
-09726

IFICIAL RECHARGE OF SUBTERRANEAN IIFERS,
demiya Nauk SSSR, Moscow. Institut Geologii nykh Mestorozhdenii, Petrografii, Mineralogii i khimii.
primary bibliographic entry see Field 04B.
-09727

IFICIAL RECHARGE FOR GROUND- TER STORAGE IN THE UNSATURATED E,
and Agricultural Organization of the United ons, Rome (Italy).
primary bibliographic entry see Field 04B.
-09728

UNDWATER POTENTIAL AND SCOPE OF DY OF WATER MOVEMENT IN UNSATU- ED ZONE IN EAST PAKISTAN,
Pakistan Water and Power Development ority, Dacca.
Ahmed.
ch resume. In: Water in the Unsaturated Zone, I, Proceedings of the Wageningen Symposium, Netherlands, June 19-25, 1966, International ciation of Scientific Hydrology, Publication 3, p 886-895, 1968. 10 p, 3 fig, 2 tab, 10 ref.

riptors: *Infiltration, *Drainage, *Unsatu- flow, Recharge, Soil water movement, ologic budget, Evapotranspiration, Water ice, Water levels, Water resources develop- , Water resources, Groundwater.
ifiers: *Pakistan.

work and studies in East Pakistan have so far confined to the occurrence of surface and ndwater with little or no regard to the unsatu- zone between the land surface and saturated materials. This zone has a significant in- ce on the distribution of both surface and ndwater, especially in a country where the system drains one of the heaviest rainfall areas e world. Moreover 80% of this precipitation rs during the monsoon months from June to mber, when at least 25% of the country is ed, high humidity persists and the maximum erature stays about 90 deg F. Water balance thus is a unique problem. The dynamic ef- on the water distribution by hydrologic sses in the unsaturated zone should be con- d in evaluating the total water resources of ountry. The movement of this water, particu- the rate, as well as the importance of this to evapotranspiration, drainage for agricul- productivity and its contribution to ground- reservoir is estimated. (See also W70-09730 W70-09568 thru W70-09592) (Knapp-USGS)
-09729

HORIZONTAL SEEPAGE THROUGH UNCONFINED AQUIFERS TAKING INTO ACCOUNT FLOW IN THE CAPILLARY FRINGE,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
E. G. Youngs.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 897-905, 1968. 9 p, 4 fig, 7 ref.

Descriptors: *Groundwater movement, *Mathematical studies, Infiltration, Seepage, Recharge, Flow, Porous media, Saturated flow, Water table, Darcys law, Soil water movement.
Identifiers: Groundwater flow equations.

Equations are given to calculate the horizontal component of groundwater movement between the top of the capillary fringe and a horizontal impermeable bottom boundary of an aquifer with a free water surface. Also considered are seepage through dams and drainage to ditches. Because infiltration flow is nearly vertical, total horizontal seepage may be considered to take place in the saturated flow region. (See also W70-09731 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09730

SOME OBSERVATIONS ON FLOW IN THE CAPILLARY FRINGE,
J. N. Luthin.
Text in English; French resume included. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, pp 905-909, 1968. 5 p, 1 fig, 1 tab, 11 ref.

Descriptors: *Soil water movement, *Groundwater movement, *Capillary fringe, *Computer models, Mathematical studies, Soil moisture, Hydraulic conductivity, Capillary conductivity, Percolation, Pore pressure, Unsaturated flow.
Identifiers: Capillary fringe movement.

A discussion if given of the effect of the capillary fringe on groundwater flow. It appears that the influence of the capillary fringe can be taken into account in calculations made with a computer, when the relationship between capillary conductivity and soil moisture content is known. For the steady state situation the modified form of the Laplace equation can be used satisfactorily in the computer for obtaining flow nets and flow into a facility or through some porous media. However, for the transient problem the situation is by no means clear. The computer relies upon some known relationship between the capillary conductivity of the soil and some other soil property that emergesfrom the solution. The relationship between the capillary conductivity and the soil moisture content must be inserted into the procedure in order to obtain a satisfactory solution. (See also W70-09708 and W70-09568 thru W70-09592). (Knapp-USGS)
W70-09731

MATHEMATICAL MODELS IN SOIL PRODUCTIVITY STUDIES, EXEMPLIFIED BY THE RESPONSE TO NITROGEN,
Institute for Land and Water Management Research, Wageningen (Netherlands).
W. C. Visser.
Miscellaneous Reprints 78, Plant and Soil, III, 2, April 1969, p 161-182. 22 p, 7 fig, 3 tab, 4 ref.

Descriptors: *Mathematical models, *Soil surveys, Nitrogen, *Computer programs, *Linear programming, *Growth rates.

A mathematical model was constructed for estimating crops yield, with the largest possible general significance for complex interaction of favorable and adverse factors. The model was constructed in order to have available a means of analyzing effects of growth factors which were less manageable than fertilizers, as is the case with the factors dependent on the water management. The growth equation formulated was described by a linear relation of mass flow, diffusion and root activity. The growth model was based on four hypotheses dealing with the stresses occurring in the plant in case of a non-harmoneous uptake of nutrients. In the growth equation a model for two factors were constructed. For the first factor the change in level of fertility of the soil after repeated applications of fertilizer was inserted. The second step was the construction of the part of the formula accounting for the adverse influence of high nitrogen applications. Five unknowns were determined and a first approximation obtained by a geographical solution. Results for nitrogen, phosphate, and potassium applications were given as well as a discussion of the effect unknown factors would have. The first model constructed used computers. The construction of the model was discussed step-by-step to show that at any separate point the relevant biological knowledge can be formulated and given its proper place. (Kriss-Cornell)
W70-09820

EFFECT OF THE SOL-GEL TRANSFORMATION IN CLAY-WATER SYSTEMS ON BIOLOGICAL ACTIVITY: 2. SODIUM UPTAKE BY CORN SEEDLINGS,
Pennsylvania State Univ., University Park. Dept. of Soil Science; and Purdue Univ., Lafayette, Ind. Dept. of Soil Chemistry.
For primary bibliographic entry see Field 02I.
W70-09842

AN INSTRUMENTED EXPERIMENTAL SITE FOR THE INVESTIGATION OF SOIL MOISTURE, FROST, AND GROUNDWATER DISCHARGE,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02C.
W70-09850

SURFACE-WATER INFILTRATION AND GROUNDWATER MOVEMENT IN ARID ZONES OF VENEZUELA,
Instituto Venezolano de Investigaciones Cientificas, Caracas.
For primary bibliographic entry see Field 02F.
W70-09887

INFILTRATION EQUATIONS FROM RATE-OF-ADVANCE DATA,
Saskatchewan Univ., Saskatoon.
Donald I. Norum, and Don M. Gray.
Proceedings of the American Society of Civil Engineers, Journal of the Irrigation Drainage Division, Vol 96, No IR2, p 111-119, June 1970. 9 p, 2 fig, 13 ref, 2 append.

Descriptors: *Infiltration, Irrigation, *Infiltrometers, Groundwater movement, Permeability, Seepage, Coefficients, *Border irrigation, Irrigation water, *Equations, Canal seepage.
Identifiers: *Infiltration rate, *Irrigation advance, Flow depth.

A method was developed for determining infiltration equations from rate-of-advance data using solutions of the Lewis-Milne border irrigation equation, plotted in dimensionless form on logarithmic paper. Rate-of-advance data were superimposed on the solutions and the coefficients determined from the matching factors for the best fit curve. The basic assumption was that the depth of flow on the surface is constant. If sufficient data are available, the technique can be extended to determine the average depth of flow on the surface. (USBR)
W70-09930

SOILS AND THE MAINTENANCE OF THEIR FERTILITY AS FACTORS AFFECTING THE CHOICE OF USE OF LAND,
G. Aubert.

In Use and Conservation of the Biosphere, p 47-69, Unesco, Paris, 1969.

Descriptors: *Soil physical properties, *Soil chemical properties, *Soil conservation, *Fertility, *Soil environment, Soil aggregates, Soil analysis, Soil engineering, Soil erosion, Soil horizons, Soil microbiology, Soil moisture, Soil properties, Soil stabilization, Soil treatment, Soil water, Soil water movement, Soil-water-plant relationships, Agriculture, Forestry, Irrigation effects, Arid lands, Tropical regions.
Identifiers: *Agricultural practices, *Temperate zones.

With increases in world populations, soil productivities have been subjected to various pressures. The various productive uses of soils are outlined with emphases on agriculture and its counterpart, forestry. The concept of soil fertility and the difficulties in defining and measuring it are considered. Probably no human activity is as destructive to the whole spectrum of soil physico-chemical and biotic properties as agriculture. The most prominent problems are: (1) During early cultivation, root system changes, ploughing and irrigation alter the physical properties of the soil (2) Wind and water erosion overcome pedogenic factors, decreasing soil depths (3) Subsequent dessication, soil Na build-up and differential upper horizon erosion decreases fertility (4) Deteriorating oxidation-reduction conditions occur, particularly as results of irrigation (5) Soil nutrients may decrease, also lowering fertility (6) Leaching, with subsequent effects on soil salinity. Examples of these problems are drawn from all parts of the world, and methods of ameliorating their effects are outlined. Views of proper national resource utilization in terms of total national and world economics are advanced. It is argued that forms of soil resource development, both in time and space, must be rationally considered and the options carefully examined. (Casey-Arizona)
W70-09956

2H. Lakes

COASTAL ENTRAPMENT IN LAKE HURON,
Waterloo Univ. (Ontario).
G. T. Csanady.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 8 fig, 1 ref.

Descriptors: *Lake Huron, *Water circulation, *Cooling water, Nuclear powerplants, Mixing, Fluorescence, Dye releases, Bays, Diffusion, Water temperature, Pumping plants.
Identifiers: Concentration, Slick, Waterloo (Ontario, Canada).

In Lake Huron at Douglas Point, a study was made of the water exchange mechanism between the shore zone and the main mass of the lake. Earlier experiments had shown a tendency for the tagged cooling water of the Douglas Point Nuclear Power Station to remain trapped in the shore zone shuttling back and forth parallel to the shore. A saturation run was envisaged, consisting of a continuous discharge of Thodamine B dye for a period of some three weeks. After continuous sampling and fluorometric observations during these three weeks, it was concluded that no dye concentration build-up was observed except dye retention to a very minor extent in bays and other sheltered pockets of water. Owing to the fortunate choice of location near a dynamically active part of Lake Huron, the cooling water efflux from the Douglas Point station mixes readily with the main lake mass, so that no long-term build-up of concentrations need be feared. On a short-term basis, shore concentrations in the vicinity of the station can be almost as high as concentrations in the efflux. (Osborne-Vanderbilt)
W70-09606

VARABILITY OF WINTERKILL SURVIVAL IN FISHES,
Wisconsin Univ., Madison. Water Resources Center.
For primary bibliographic entry see Field 05C.
W70-09671

MAGNITUDE OF WAVES ON LAKE BUTTE DES MORTS AND THEIR EFFECT ON LAKE DEPTH AND SEDIMENT DISTRIBUTION,
Wisconsin State Univ., Oshkoch. Limnology Lab.
Samuel S. Harrison.
Available from the NTIS as PB-194 055, $3.00 in paper copy, $0.65 in microfiche. Report of Investigations No. 2, August 1970. 45 p, 2 tab, 15 fig, 3 ref. OWRR Project A-027-WISC (1).

Descriptors: *Waves (Water), *Sediment transport, Beach erosion, *Bottom sediments, Mud-water interfaces, Lake beds, Limnology, *Sedimentation rates, Weather data, Wisconsin.
Identifiers: Lake Butte des Morts.

The relationship between wind speed and the height, wave length, and period of waves occurring on Lake Butte des Morts was established from field data collected during the summers of 1969 and 1970. Using this relationship, an estimate was made of the frequency of occurrence of waves of various magnitudes on the lake. A chart was constructed so that the orbital diameter and orbital velocity of water moving over the lake bed in response to waves of known magnitude in a known depth of water can be determined. Threshold-orbital-velocity curves for sand-size sediment are superimposed on the chart. The upper half of the Lake Butte des Morts is four to five feet deep. Because waves are of sufficient magnitude to move fine sand on an average of about 40 days per year, and coarse sand about 8 days per year in the upper end of the lake, the depth of this part of the lake is thought to be wave controlled. It is doubtful, however, that waves reach a magnitude sufficient to move the fine-grained organic-rich sediment in the lower end of the lake which is 8 to 9 feet deep.
W70-09672

DEPOSITIONAL ENVIRONMENTS OF LAKE SUPERIOR SANDS THROUGH GRAIN SIZE ANALYSIS,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 02J.
W70-09673

SEDIMENTS AND GEOLOGY OF BOIS BRULE RIVER, WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 02J.
W70-09675

EVALUATION OF GRAIN-SIZE PARAMETERS IN LACUSTRINE ENVIRONMENTS,
Computer Data Processors Ltd., Calgary (Alberta); and Calgary Univ. (Alberta). Dept. of Geology.
For primary bibliographic entry see Field 02J.
W70-09693

BOTTOM SEDIMENTS OF LAKE MANAZALAH, EGYPT,
Alexandria Univ. (Egypt). Dept. of Oceanography; and Institute of Oceanography, Alexandria (Egypt).
Saad K. El-Wakeel, and Saad D. Wahby.
Journal of Sedimentary Petrology, Vol 40, No 1, p 480-496, March 1970. 17 p, 6 fig, 3 tab, 48 ref.

Descriptors: *Bottom sediments, *Lakes, *Deltas, Phosphorus, Organic matter, Particle size, Sands, Silts, Clays, Sedimentation.
Identifiers: *Nile River, Egypt.

Lake Manzalah is the largest of the Delta Lakes of Egypt. Grab samples were collected from the bot tom of the lake and subjected to mechanical an chemical analysis. The majority of samples ar badly sorted with an average median diameter o 85.6 microns. The predominant type of sedimen covering the bottom the lake is the complex typ sand-silt-clay followed in abundance by the claye sand and silty clay. There is a basinward increase i grain size of sediments. The average carbonat content is 34.88% and its distribution on the bot tom generally follows the same pattern of the grai size distribution of sediments. The average organi matter content is 2.56% whereas the organi matter content increases with the decrease of medi an diameter of grains. The C:N ratio range between 5 and 17 with an average of 9.7. Th average phosphorous content is 0.056%. Th phosphorous content increases with the decrease o median diameter of grains. Available ferric iron i sediments ranges betwee 0.2 and 3% with a average of 1%. Interrelations between the grai size, carbonate, organic matter, phosphorous an available iron are discussed. (Knapp-USGS)
W70-09699

DETECTION OF UPWARD PERCOLATION O SALINE LAKE WATER,
Weizmann Inst. of Science, Rehovoth (Israel); an Water Planning for Israel, Tel Aviv. Hydrologic Branch.
C. J. Braudo, F. Mero, and A. Mercado.
ASCE Proceedings, Journal of the Hydraulics Div sion, Vol 96, No HY9, Paper 7519, p 1795-180 September 1970. 8 p, 5 fig, 4 ref.

Descriptors: *Salinity, *Lakes, *Water pollutio sources, *Percolation, Seepage, Groundwat movement, Saline water systems, Saline water i trusion, Radioactivity, Tracers, Water chemistr Mixing.
Identifiers: Lake Kinneret (Israel).

A method for detecting and locating sources saline water percolating through the bottom Lake Kinneret, Israel, is described. The method based on the fact that the salinity of the springs the area described is accompanied by natu radioactivity. A large area was monitored f radioactivity and areas were selected for detail measurements of the salinity of the mud. Dire flow measurements are used to determine the co tribution of the sources to the salinity of the lak (Knapp-USGS)
W70-09838

WATER WAVES GENERATED BY LAN SLIDES IN RESERVOIRS,
California Univ., Berkeley. Dept. of Civil Engine ing.
Robert L. Wiegel, Edward K. Noda, Edward M. Kuba, Dennis M. Gee, and Gordon F. Tornberg.
ASCE Proceedings, Journal of the Waterways a Harbors Division, Vol 96, No WW2, Paper 7279 307-333, May 1970. 27 p, 25 fig, 25 ref, appe State of California, Dept of Water Resources, St dard Agreement No. 455494.

Descriptors: *Waves (Water), *Landslid *Reservoirs, *Tsunamis, *Hydraulic mod Mathematical models, Model studies, Bores.
Identifiers: Wave runup, Landslide waves.

Results of hydraulic laboratory tests of an ideali rockfall are presented, with the main parame being the ratio of rockfall width to water depth a Froude number. For a large range of these t parameters, a linear theory for the generation water waves by a similar mechanism is useful a guide to interpreting the results. For large value the two parameters, the linear theory is a marg usefulness. It is shown by means of the result two similar tests, with a geometric scale ratio 1:4, that a small model test can be used to pre the results to be expected from a large model even in the range where bores form, provided velocity time histories of the falling rock similar. (Knapp-USGS)

0-09839

ELIMINARY OBSERVATIONS OF THE DROMECHANICS, NUTRIENT CYCLES D EUTROPHICATION STATUS OF LAKE NNERET (LAKE TIBERIAS),
nological Lab., Tabigha (Israel).
Serruya, S. Serruya, and T. Berman.
rhandlungen der Internationalen Vereinigung Theoretische und Angewandte Limnologie, Vol p 342-351, 1969. 7 fig, 1 tab, 8 ref.

scriptors: *Cycling nutrients, *Eutrophication, ydrodynamics, Lakes, Internal water, Waves ater), Diurnal, Epilimnion, Winds, Thercline, Temperature, Currents (Water), polimnion, Algae, Nitrogen, Phosphorus, Oxn, Carbon, Enzymes, Sampling, Bottom sedints, Sodium, Potassium, Iron, Manganese, Calci, Pigments.
ntifiers: *Lake Kinneret (Israel).

istence of internal waves in Lake Kinneret rael) was confirmed. In early May 1968, with ll developed thermocline, characteristic internal ves were observed, averaging 11 hours, occurg regularly at semi-diurnal intervals, correlated newhat with periodic west wind. In the hypolimn, large quantities of ammonium-nitrogen and hophosphate concentrations increasingly accuilated from May to December. Ratio of total ailable nitrogen to orthophosphates is high in bruary and decreases rapidly to mid-summer. similation rate and regeneration in epilimnion is out four times greater in spring than summer. nder prevailing lake conditions, during the composition of organic matter in hypolimnion, every phosphorus atom liberated as phosphate, 0 atoms of oxygen are used for oxidation of corsponding total quantity of organic matter. Study the epolimnion strongly suggests that the high ygen:phosphorus ratio reflects the high organic ntent of lake algae and particularly their high trogen:phosphorus ratio. High level of organic atter indicates that sediments are providing quanies of nutrients, particularly ammoniumtrogen. Biweekly samples of alkaline onophosphoesterases are measured. In bottom posits, content of organic carbon and Kjeldahl trogen is rather high. There are indications of cent enhanced eutrophication, supported by sults of pigment extraction from sediments. ones-Wisconsin)
70-09889

OLOMIXY AND OLIGOMIXY IN LAKE MAGIORE: INFERENCE ON THE VERTICAL DISRIBUTION OF ZOOPLANKTON,
ivia Tonolli.
erhandlungen der Internationalen Vereinigung r Theoretische und Angewandte Limnologie, Vol 7, p 231-236, 1969. 1 fig, 2 tab, 9 ref.

escriptors: *Lakes, *Zooplankton, *Distribution atterns, Oligotrophy, Temperature, Winds, opepods, Rotifers, Seasonal, Dissolved oxygen, hemicals, Algae, Migration, Profundal zone.
dentifiers: *Holomixy, *Oligomixy, *Lake Magiore (Italy), *Vertical distribution, Cladocerans, lixodiaptomus laciniatus, Eudiaptomus vulgaris, yclops abyssorum, Cyclops landei, Mesocyclops euckarti, Megacyclops viridias, Heterocope aliens.

very five-seven years there is a complete overturn f Lake Maggiore (Italy) waters. This study records oplankton distribution from surface to maximum epth. During the holomictic winter, a progressive ecrease of copepod densities in upper 50 meters ccurred from January to the end of March, with n increase in deeper layers. These individuals, verturned during winter holomixy to the deepest ayers, could not find enough food in those layers or energy to reach water layers more suitable from trophical point of view. This upward effort is afected by complete lack of vertical gradients in the cological parameters, as determined by the olomixy, and zooplankton does not generally move straight upward from deep to superficial waters. During the overturn, the deepest layers are recharged with oxygen. Nutrients, concentrated in deep water, are suddenly brought in high concentrations to the more superficial layers and abruptly made available for algal development, exactly when zooplankton feeders are numerically depressed. After full circulation, spring 1963, there was an algal surplus resulting in nutrient enrichment. Kinetics of an oligomictic lake at winters' ends are responsible for productivity for the year and even for some subsequent years. (Jones-Wisconsin)
W70-09890

NITROGEN DISTRIBUTION IN SOME WISCONSIN LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
Dennis R. Keeney, John G. Konrad, and Gordon Chesters.
Journal of the Water Pollution Control Federation, Vol 42, No 3, Part 1, p 411-417, 1970. 3 tab, 20 ref.

Descriptors: *Nitrogen, *Distribution, *Wisconsin, *Lakes, *Sediments, Eutrophication, Phosphorus, Dissolved oxygen, Hypolimnion, Aquatic weeds, Sampling, Oligotrophic, Hardness (Water), Depth, Hydrogen ion concentration, Nitrogen compounds, Soils, Mineralogy, Ammonium compounds, Freeze drying.
Identifiers: Algal blooms, Mesotrophic, Soft water, Lake types, Wisconsin lakes.

Forms and distribution of nitrogen in some Wisconsin lake sediments as function of lake type and trophic level are reported. The distribution (based on total sediment organic nitrogen) of the various forms of nitrogen hydrolyzable by 6N HCl did not differ markedly among sediment samples. No consistent effects of location, water composition, pH, or carbonate content of the sediments were found in the organic-nitrogen distribution data. An average, about 45% of the organic nitrogen in sediments exists as unidentified acid-hydrolyzable and acid-nonhydrolyzable nitrogen. The hard-water lake sediment samples contained greater amounts of fixed ammonium-nitrogen compared with soft-water samples, indicating mineralogical differences. It is impossible, with the limited number of samples, to discern any effects of lake trophic level on the fixed and exchangeable ammonium-nitrogen contents of lake sediments. Similar forms of nitrogen occur in lake sediments as in soils, but the nitrogen distribution differs somewhat. Decrease in hexosamine-nitrogen accompanied by an increase in amino acid-nitrogen with increasing lake fertility level indicates a greater microbial turnover of organic nitrogen in oligotrophic lakes, probably due to the higher dissolved oxygen in the hypolimnionic waters. (Jones-Wisconsin)
W70-09891

THERMAL REQUIREMENTS TO PROTECT AQUATIC LIFE IN TEXAS RESERVOIRS,
Texas Electric Service Co., Fort Worth.
Howard R. Drew, and John E. Tilton.
Journal of the Water Pollution Control Federation, Vol 42, No 4, p 562-572, 1970. 3 fig, 17 ref.

Descriptors: *Reservoirs, *Texas, *Aquatic life, *Thermal water, Temperature, Water quality, Fish, Fisheries, Sampling, Creel census, Bass, Fish management, Channel catfish, Rotenone, Buffalo fishes, Carpsucker, Carp, White bass, Nutrients, Hydroelectric plants, Colorado River, Fishkill, Recreation, Aeration, Epilimnion, Stratification, Sunfishes, Heat transfer.
Identifiers: *Micropterus salmoides, Ictalurus punctatus, Pomoxis annularis, Ictiobus bubalus, Carpiodes carpio, Cyprinus carpio, Dorosoma cepedianum, Dorosoma petenense, Bottom-feeding fauna, Shad, Roccus chrysops.

Thermal requirements for aquatic life that will permit maximum use of Texas' resources are reviewed. Almost all Texas streams and reservoirs have been investigated by water quality studies, creel censuses, and continuous sampling of fish populations. Fish evolution in a newly constructed reservoir follows a pattern of exceptional growth of game fish during the first year or two. The game fish:rough fish ratio inverts after that period. Whereas initially total weight of game fish may exceed 50% of all fish taken, by the fourth or fifth year, coarse or undesirable fish dominate and usually make up about 75% of total nettable fish weight. Two Texas reservoirs, primarily used for cooling of steam electric power generation, have remained highly productive since impoundment and have maintained well-balanced fish populations; in these, no decline in game fish population with reservoir age, such as experienced in other Texas reservoirs, has occurred. This is attributed primarily to the result of water circulation and increased temperatures from the power plant. Operation of the steam electric plant increases the oxygen balance of the whole lake. The large flow of warm water can be an effective fish management tool. (Jones-Wisconsin)
W70-09893

NITROGEN LOSSES FROM ALKALINE WATER IMPOUNDMENTS,
San Diego State Coll., Calif. Dept. of Civil Engineering.
Frank E. Stratton.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 95, No SA2, p 223-231, 1969. 5 fig, 1 tab, 3 ref.

Descriptors: *Alkaline water, *Nitrification, *Nitrogen, Impoundments, Ammonia, Analysis, Analytical techniques, Hydrogen ion concentration, Temperature, Winds, Effluents, Lakes, Surface waters, California.
Identifiers: Elfin Forest Lake (Calif), Gaseous ammonia nitrogen, Degasification.

A method of estimating the loss of gaseous ammonia from alkaline waters consists of analysis of samples from outdoor impounded water subject to mixing by wind. Another method involves the use of a floating cell and acid trap to determine ammonia liberated from an impoundment. The field tests were conducted from June to September in two small California eutrophic impoundments: Elfin Forest Lake with pH 9.5-9.8, and a pH 9.1 effluent pond at the Santee Water Reclamation. The measured rate of loss of ammonia nitrogen for the Elfin Forest Lake was 3.3 milligrams per square foot/day, whereas that for the Santee pond, 9.1 milligrams per square foot/day. The determined values constituted 14% and 22% of the predicted values for these basins, respectively. (Wilde-Wisconsin)
W70-09894

THE SEGREGATION OF THE BENTHIC FAUNA IN SUBALPINE LAKES (IN FRENCH),
Lyon Univ. (France). Faculte des Sciences.
Jacques Wautier, and Jacques Juget.
Bulletin Societe Zoologique de France, Paris, Vol 94, No 2, p 277-284, 1969. 2 fig, 1 plate, 15 ref.

Descriptors: *Benthic fauna, *Lakes, *Ecological distribution, Biological communities, Ecology, Behavior, Speciation, Lake stages, Nematodes, Oligochaetes, Copepods.
Identifiers: Subalpine lakes, Microevolution, Lake Geneva.

Studies of benthic animals revealed that ecological diversity of subalpine lakes plays a decisive role in distribution and introlacustrine evolution of organisms reflected in their morphology and physiology. This is particularly true of Nematoda, Oligochaeta, and Copepoda. Lake Leman (Geneva) with its great depth and the presence of some relic life forms provides an especially noteworthy illustration of the pertinent relationships. (Wilde-Wisconsin)
W70-09898

MAN'S INFLUENCE ON LAKE ERIE,
Southern Illinois Univ., Carbondale. Dept. of Botany.
Jacob Verduin.
The Ohio Journal of Science, Vol 69, No 2, p 65-69, 1969. 1 fig, 2 tab, 12 ref.

Descriptors: *Lake Erie, *Ohio, Swamps, Farms, Silts, Light penetration, Biota, Nutrients, Phosphorus, Oxygen, Sewage effluents, Cisco, Walleye, Seiches, Mayflies, Hydrogen ion concentration, Photosynthesis, Nitrogen, Detergents, Phytoplankton, Benthic fauna, Carbon dioxide, Bloodworms, Yellow perch, Midges.
Identifiers: *Man's influence, Maumee River, Toledo (Ohio), Leucichthys artedi, Esox mosquinongy, Stizostedion vitreum, Hexagenia limbata, Asterionella formosa, Tabellaria fenestrata, Melosira ambigua, Melosira binderana, Fragilaria capucina, Coscinodiscus radiatus, Chironomus plumosus, Perca flavescens, Cladophora glomerata, Great Black Swamp (Ohio).

Conversion of northwestern Ohio's Great Black Swamp to farm land during the last half of the 19th century had a profound, but scantily documented influence on Lake Erie. Silts, once largely filtered by swampland vegetation, were, with the destruction of that vegetation, carried into Lake Erie, reducing light penetration and significantly altering the lake's biota. More recently enhancement of plant nutrients, especially phosphorus, which has increased 5-fold since 1948, has supported nuisance levels of plant growth creating severe oxygen depletion near the lake bottom and responsible for additional major and undesirable changes in species composition of plant and animal communities. The solution to this problem is removal of plant nutrients from the waters before they enter Lake Erie. The 'living filter' treatment, in which sewage plant effluents are filtered through root zones of plant communities, seems most promising. This treatment effectively removes nutrients, converting them to plant products. Another model, where effluent from sewage treatment plants is passed through a series of artificial lakes, processes the effluents effectively so that final-stage lakes are excellent recreational facilities, and the released waters do not burden aquatic environments. (Jones-Wisconsin)
W70-09900

PHOSPHATE IN LAKE KINNERETH,
Ministry of Agriculture, Haifa (Israel). SeaFisheries Research Station.
O. H. Oren, and Rosa Ravid.
Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 334-341, 1969. 3 fig, 3 tab, 7 ref.

Descriptors: *Lakes, *Phosphates, *Distribution patterns, Seasonal, Diurnal, Phosphorus, Thermocline, Depth, Beds under water, Oxygen, Temperature, Epilimnion, Hot springs, Chlorides, Calcium, Hydrogen ion concentration, Hypolimnion, Phytoplankton.
Identifiers: *Lake Kinnereth (Israel), Vertical distribution, Salt water carrier, Orthophosphates.

Lake Kinnereth (Israel) contains relatively large quantities of orthophosphate as well as total phosphorus which, during most years, are near the bottom--not in the whole hypolimnion. Integrated total quantity of total phosphorus does not change considerably in the whole lake, however the layers, containing phosphorus, do change. Before the end of the seasonal stratification, more than 40% of the total phosphorus is concentrated in the 30-40 meter layer, the minimum of total phosphorus in the 10-20 meter layer. In January, the layer between 30-40 meters is still undistrubed, while mixing has taken place in upper layers. In February a considerable percentage of the total phosphorus is still in the bottom layer, although decreased by 25%; at that time it is mainly found at the surface where spring phytoplankton bloom has begun. During March, minimal quantities of total phosphorus are found near the bottom, maxima at surface and upper layers. The phosphorus content of the lake is decreasing. This preliminary investigation shows the total quantity of orthophosphate has decreased in the four years since the salt water carrier has been in operation; this carrier contains quantities of phosphate and total phosphorus below the Tiberias Hot Springs. (Jones-Wisconsin)
W70-09901

TEMPORAL CHANGES OF PHYSICAL AND CHEMICAL FACTORS IN A SHALLOW ASTATIC SALINE LAKE,
G. E. White, and R. Hartland-Rowe.
Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 440-446, 1969. 10 fig, 3 ref.

Descriptors: *Saline lakes, *Shallow water, *Physical properties, *Chemical properties, Ecology, Salt tolerant, Grasses, Temporary pond stage, Sampling, Quartz, Clays, Turbidity, Depth, Temperature, Hydrogen ion concentration, Alkalinity, Winds, Dissolved solids, Chlorides, Sulfates, Sodium, Magnesium, Iron, Oxygen, Crustaceans.
Identifiers: *Astatic lakes, Alberta (Canada), Chain Lakes (Canada), Anostraca, Hordeum jubatum, Puccinellia nuttaliana, Distichlis stricta, Chenopodium glaucum, Chenopodium salinum, Suaeda depressa, Scirpus paludosus, Specific conductance, Lepidurus lemmoni, Branchinecta gigas, Branchinecta mackini.

This study was undertaken to gain information on one of the larger temporary saline waters of Alberta and its Anostracan fauna. Wanek Lake, one of the Chain Lakes (Alberta, Canada) lacks any surface outflow but is fed by intermittent streams in the springtime, resulting in a recurrent temporary pool. Its bed is composed of a mixture of rounded quartzite grains and clay and has excessive turbidity. Water depth decreases with time throughout the season. Total mixing is the usual condition in this very shallow lake. Changes in hydrogen ion concentration show a gradual increase during the season mainly due to evaporation. It is a sulphate-carbonate lake, with sodium and magnesium the predominant cations; concentrations of iron were unusually high. Two of the three species of euphyllopod Crustacea occurring in Wanek Lake--Branchinecta gigas and B mackini--were studied. Factors responsible for their disappearance before the lake dired up completely are considered. These preliminary observations on Wanek Lake reveal that we can observe an annual sequence of physical and chemical changes to which certain euphyllopods appear to be especially well adapted. (Jones-Wisconsin)
W70-09902

THE CONDITION OF LAKES AND PONDS IN RELATION TO THE CARRYING OUT OF TREATMENT MEASURES,
For primary bibliographic entry see Field 05C.
W70-09941

2I. Water in Plants

WATER MOVEMENT AND ITS UTILIZATION BY PLANTS UNDER THE DEEP WATER STORAGE IN SOIL BY USING OFF-SEASON IRRIGATION,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09585

THE EXTRACTION OF SOIL MOISTURE BY PLANTS UNDER DRY LIMIT CONDITIONS,
Hessiches Landesamt fuer Bodenforschung, Wiesbaden (West Germany).
For primary bibliographic entry see Field 02G.
W70-09588

EVAPOTRANSPIRATION OF PLANTS AND FLUCTUATION OF THE GROUNDWATER TABLE,
State Inst. of Hydrology and Meteorology, Warsaw (Poland). Water Physics Div.
For primary bibliographic entry see Field 02G.
W70-09589

THE INFLUENCE OF VARIOUS AGRICULTURAL PRACTICES ON SOIL WATER AND IN THE ZONE OF AERATION OF CHERNOZEMS (FRENCH),
For primary bibliographic entry see Field 02G.
W70-09590

EFFECT OF THE SOL-GEL TRANSFORMATION IN CLAY-WATER SYSTEMS ON BIOLOGICAL ACTIVITY: 2. SODIUM UPTAKE BY CORN SEEDLINGS,
Pennsylvania State Univ., University Park. Dept. of Soil Science; and Purdue Univ., Lafayette, Ind. Dept. of Soil Chemistry.
D. E. Baker, and P. F. Low.
Soil Science Society of America Proceedings, Vol 34, No 1, p 49-56, January-February 1970. 8 p, 9 fig, 2 tab, 24 ref.

Descriptors: *Clays, *Gels, *Soil-water-plant relationships, Ion transport, Ion exchange, Viscosity, Water chemistry.
Identifiers: Clay-water systems.

Homoionic Na- and K0 clay mixtures were prepared from Wyoming bentonite with water to produce clay-water systems. These systems were extruded through a hypodermic needle to orient the particles. Some of the systems were disturbed by tapping their containers on the laboratory bench. The following quantities were measured: viscosity; relative partial molar free energy of NaCl, KCl and HCl; and water tension. Viscosity, free energy of HCl, and water tension were decreased by disturbing the clay systems, whereas the free energies of both NaCl and KCl were increased. Samples of the clay systems were extruded around the radicles of corn seedlings. Na uptake was determined by analyzing the seedlings for Na-22. Na uptake increased curvilinearly with Na-clay content in the range 0-4% clay and then leveled off. In the curvilinear range, Na uptake was directly proportional to the free energy of NaCl. Na uptake was greater from the disturbed than from the undisturbed systems. Because the disturbance also increased the free energy of NaCl, it was concluded that Na uptake depended on this quality. (Knapp-USGS)
W70-09842

ESTIMATING THE TRITIUM INPUT TO GROUNDWATER FROM WINE SAMPLES: GROUNDWATER AND DIRECT RUN-OFF CONTRIBUTION TO CENTRAL EUROPEAN SUFACE WATERS,
Heidelberg Univ. (West Germany). Physikalis ches Institut.
For primary bibliographic entry see Field 02F.
W70-09873

THE EFFECT OF LAND USAGE ON AQUATIC AND SEMI-AQUATIC VEGETATION AT HIGH ALTITUDES IN SOUTHERN AFRICA,
Rhodes Univ., Grahamstown (South Africa). Dept. of Botany.
A. Jacot Guillarmod.
Hydrobiologia, Vol 34, No 1, p 3-13, 1969. 1 fig, 9 ref.

Descriptors: *Bogs, *Basalts, *Aquatic plants, *River systems, *Ecology, Conservation, Water flow, Grazing, Mining, Population, Ponds, Pondweeds, Gravels, Springs, Frost heaving.
Identifiers: *Southern Africa, *Lesotho, *Orange river, Kimberlite pipes.

ıe high altitude areas (7500 feet or greater) of ıuthern Africa serve as sources of several impor-nt rivers. The climate is harsh and rainfall and owfall are high. The topography is mainly a yered basaltic cap with volcanic vents, doleritic 'kes and kimberlite fissures. The river source eas lie mainly within the new state of Lesotho. ater flows over the basalt carrying practically no t. The river sources are ancient bogs formed on e highest mountain slopes and shallow valley ads. Most bogs are extensive and contain many rings that well up through kimberlite pipes. The getation forms a dense mat and is largely an-osperms and algae. The bogs therefore serve not ly as river sources, but also as regulators of the gh rainfall, filtering the waters through the gravel d vegetation. Population pressures have created tensified pastoral activities in Lesotho and the gh mountain areas are now being intensively azed. Grazing animals are penetrating into the gs, destroying crucial vegetation. Additionally, amond mining in kimberlite pipes is destroying e springs. The bogs cannot long stand these intru-ons and if they are destroyed, the river systems ill be critically damaged. A plea is made for ra-onal usage planning and regulation of these areas. Casey-Arizona)
'70-09950

ROWTH STIMULATION BY HIGH HLORIDE CONCENTRATIONS IN ALOPHYTES,
ommonwealth Scientific and Industrial Research rganization, Griffith (Australia). Div. of Irriga-on Research.
. Greenway.
rael Journal of Botany, Vol 17, No 3, p 169-177, 968. 4 fig, 2 tab, 13 ref.

escriptors: *Halophytes, *Chlorides, *Cations, Salt tolerance, *Plant growth, Osmotic pressure, lectrolytes, Salinity, Plant physiology, Soil-water-lant relationships, Calcium, Sodium, Magnesium, otassium, Plant growth, Turgidity, Water balance. lentifiers: *Salt-accumulating halophytes, *Salt-xcluding haliphytes, *Saltbush, *Australia, smotic adjustment.

eedlings of an Australian desert halophyte, triplex nummalaria, were grown in nutrient solu-ons of differing chloride concentrations ranging om 10-300 milliequivalents per liter and with dif-ering cations (K, Ca, Na, Mg). With Na, K and Mg hlorides growth was optimum at ranges of 100-00 milliequivalents per liter. Ca chloride caused oxic effects with increasing concentrations, which ere largely ameliorated when other cations were resent. Increased growth in NaCl solutions was ac-ompanied by increasing Na and Cl concentration nd no changes in assimilation, eliminating sub-titution of Na with K and increased photosynthetic fficiency as growth factors. Growth comparisons n media with increasing ionic concentrations in-icate that salt-excluding halophytes suffer from ow medium water potential while salt-accumulat-ng halophytes compensate by increasing internal smotic pressure. It is concluded that appropriate gricultural breeding for accumulation-type haracteristics would combine salt tolerance with rowth vigor. (Casey-Arizona)
W70-09951

CONVERGENT EVOLUTION OF MEDITER-RANEAN-CLIMATE EVERGREEN SCLEROPHYLL SHRUBS,
Stanford Univ., Calif. Dept. of Biological Sciences.
Harold A. Mooney, and E. Lloyd Dunn.
Evolution, Vol 24, No 2, p 292-303, June, 1970. 5 ig, 2 tab, 57 ref. National Science Foundation grants GB 5223, GB 8148.

Descriptors: *Leaves, *Chaparral, *Shrubs, *Semiarid climates, *Moisture stress, Germination, Soil moisture, Droughts, Root systems, Tempera-ture, Photosynthesis, Stomata, Respiration, Nutrients, Toxicity, Precipitation (Atmospheric), Soil-water-plant relationships.
Identifiers: *Sclerophyllous plants, *Evergreen leaves, *Mediterranean climates, Adaptation, Convergence, Annuals (Plants), Leaf drop, Overheating effects, Nutrient deficiencies, Fire damages, Overgrazing, Resprouting, Palatability.

The Mediterranean climatic type (summer drought, winter rain) occurs in 5 diverse, isolated parts of the world. In all areas the native vegetation is similar--a dense scrub dominated by deeprooted woody evergreen sclerophyllous species. The climate is severe with plant life because favorable soil moistures and favorable temperatures are out of phase resulting in only brief periods of vigorous growth. Many other unfavorable factors also exist. It is proposed that the adaptive possibilities of an area vary inversely with environmental stresses, explaining the high degree of vegetative convergence in Mediterranean areas. The development of the evergreen leaf is a result of the greater efficiency. In these climates, plants are prepared to photosynthesize immediately in favorable conditions, while surviving drought conditions without leaf shedding. The crucial adaptations are (1) Deep root systems enabling at least some soil moisture utilization throughout the year (2) Small leaves with proportionately greater water conducting tissue resulting in reduced desiccation susceptibility (3) Nutrient-gathering and nutrient-conservation mechanisms adapted to low soil nutrient levels in these areas (4) Seedling unpalability and fact resprouting following fires (6) Stem-flow mechanisms which trap and conserve moisture from rain. (Casey-Arizona)
W70-09952

TODAY THE ENVIRONMENT, TOMORROW THE WORLD,
Michigan Univ., Ann Arbor. Dept. of Wildlife and Fisheries.
For primary bibliographic entry see Field 06G.
W70-09953

SALT TOLERANCE OF CROPS AT GERMINATION STAGE,
Udaipur Univ., (India). Agricultural Experiment Station.
For primary bibliographic entry see Field 03C.
W70-09954

THE PHYSIOLOGY OF DORMANCY AND SURVIVAL OF PLANTS IN DESERT ENVIRONMENTS,
Hebrew Univ., Jerusalem (Israel). Dept. of Soil Science.
D. Koller.
In Symposium of the Society for Experimental Biology, Vol 23, p 449-469. Cambridge University Press, 1969. 7 fig, 9 tab, 36 ref.

Descriptors: *Arid lands, *Germination, *Photoactivation, *Temperature control, *Water control, Xerophytes, Semiarid climates, Ecology, Physiological ecology, Plant physiology, Moisture stress, Growth stages, Precipitation.
Identifiers: *Dormancy, *Regeneration buds.

The essential feature of plant dormancy is its reversibility under environmental control. In deserts moisture stress is the dominant limiting factor. Plant life is made possible only because rainfall is unevenly distributed in time and space and this is accentuated by soil properties creating differential soil moisture distributions. Since seed dormancy involves species survival, there is a universal imposition of regulating mechanisms on seed germination, ensuring it occurs only when survival probability is maximal. Precise sensitivity to ongoing environmental factors is therefore necessary and germination regulation is based on: (1) Selectivity of response mechanisms to environmental factors (2) Heterogeneity of germination requirements within the seed population. Selectivity mechanisms measure some combination of light, temperature and moisture. Numerous examples given show various seeds are capable of measuring temperature, their own depth in soil or water, the intensity, spectral composition or periodicity of light, soil water economy and soil physical properties. They may also mearure fluctuations over time, or various combinations, both simultaneous and sequential. Paradoxically, none of the germination regulation mechanisms described occurs solely in desert plants. (Casey-Arizona)
W70-09955

ANNUAL AND PERENNIAL BARRIERS IN RELATION TO WIND EROSION AND MOISTURE CONSERVATION,
Agricultural Research Service, Sidney, Mont.
For primary bibliographic entry see Field 03B.
W70-09957

INFERENCES FROM ECOLOGICAL THEORY,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
For primary bibliographic entry see Field 03B.
W70-09960

DAYTIME STOMATAL CLOSURE IN AGAVE AMERICANA AS RELATED TO ENHANCED WATER-USE EFFICIENCY,
Agricultural Research Service, Phoenix, Ariz. Water Consevation Lab.
For primary bibliographic entry see Field 02D.
W70-09964

CHARACTERISTICS OF THE ROOTS OF SOME XEROPHYTES,
New Mexico Univ., Albuquerque, N. Mex. Dept. of Biology.
Howard J. Dittmer.
In: Physiological Systems in Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 231-238, University of New Mexico Press, 1969. 2 fig, 2 tab, 10 ref.

Descriptors: *Xerophytes, *Root systems, *Xylem, *Water conservation, *Soil properties, Arid lands, Bound water, Phreatophytes, Drought tolerance.
Identifiers: *Mycorrhizas, *Root nodules, Tap roots.

There are 4 major types of desert root systems: (1) Storage roots which have relatively thick, water-retentive epidermal layers (2) Long tap roots not enlarged into storage roots (3) Relatively large lateral roots confined to the upper few inches of soil (4) Shallow fibrous roots characteristic of grasses. Penetration depths, lateral root development and root densities varies among species and are functions of genetic potential and environmental conditions. Nearly all desert root systems have mycorrhizal associations which decrease with soil dryness. Bacterial nodules on leguminous plant roots are also less abundant in arid soils. Drought resistance is mainly due to anatomical adaptations. Desert plants have a higher percentage of root xylem in relation to their diameter than more mesic plants. This results in slower water movement and greater water storage. Additionally, special cortical cells and resinous substances increase bound water content. (Casey-Arizona)
W70-09966

PHYSIOLOGICAL SPECIALIZATIONS OF AMPHIBIANS TO HABITATS OF VARYING ARIDITY,
Minnesota Univ., Minneapolis. Dept. of Zoology.
William D. Schmid.
In: Physiological Systems in Semiarid Environments, Hoff, C. C., and Riedesel, M. L. (editors), University of New Mexico Press, p 135-142, 1969. 1 tab, 31 ref. National Science Foundation Grant GB-6920.

Descriptors: *Water conservation, *Amphibians, *Water balance, *Physiological ecology, *Metabolism, Animal behavior, Respiration, Animal physiology, Urine, Semiarid climates, Arid

lands, Aquatic animals, Xerophilic animals, Sodium, Osmotic pressure.
Identifiers: *Integument, *Urinary bladder, *Active transport, Fossorial animals.

Due to lack of behavioral and microclimatic factors involved in amphibian water conservation, it is necessary to discuss relevant problems on the bases of (1) Whole organisms (2) Integument and urinary bladder organs (3) Nitrogen excretion. Terrestrial species have greater desiccation tolerances and faster recovery from moisture stress than aquatic species. Current evidence suggests great directional rates of water movement in terrestrial species integuments. Behavioral avoidance related to fossorial habits may also be important in many terrestrial species. The skin and the urinary bladder function in the active uptake of Na. The urinary bladder is larger in terrestrial species and functions mainly as a water storage organ, where as it is primarily an excretory organ in aquatic species. Aquatic species excrete ammonia while semi-aquatic and terrestrial species excrete urea, thus avoiding toxic accumulation. The more terrestrial the life form, the greater is the tolerance to hyperosmotic urea. (Casey-Arizona)
W70-09967

BODY COMPOSITION OF THE KANGAROO RAT (DIPODOMYS MERRIAMI),
Nevada Univ., Reno. Desert Research Inst.
Leslie Startin.
In: Physiological Systems In Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 35-44, University of New Mexico Press, Albuquerque, 1969. 3 fig, 2 tab, 3 ref. Supported by Nevada Heart Association and National Science Foundation Grant GB-5217.

Descriptors: *Rodents, *Physiological ecology, *Animal metabolism, *Water balance, Animal physiology, Reproduction, Diets, Ecology, Semiarid climates, Arid lands.
Identifiers: *Kangaroo rat, *Body fluids, *Body solids, *Animal fats, Metabolic water, Mojave Desert.

The kangaroo rat is a nocturnal desert rodent capable of living without drinking water and active in all seasons in the Mojave Desert. Rats were trapped for a year (1967), and analyzed for water content, total body protein and solids, ash, fat and heart composition. Water content increased during the spring then decreased to a constant level for the rest of the year. The increase was correlated with a diet of greens during the primary reproductive period. The water content did not increase during unusually heavy summer rains and resulting greenery, indicating its independence of available environmental water except during periods of high metabolic demand. Total body protein, total body solids, ash and heart composition remained relatively constant over the entire year. Fat content increased in late spring and summer and decreased in fall and winter ranging from 1-9 percent. The generally low fat level is probably an adaptation to a mobile, speed-oriented was of life. Increases in fat content may be correlated with increases in seed consumption, since seeds are high in fats and oils. (Casey-Arizona)
W70-09968

OBSERVATIONS ON THE STRUCTURE AND FUNCTION OF THE KIDNEY OF THE VAMPIRE BAT (DESMODUS ROTUNDUS MURINUS),
Arizona Univ., Tucson. Dept. of Anatomy.
Roy Horst.
In: Physiological Systems In Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 73-83, University of New Mexico Press, Albuquerque, New Mexico, 1969. 2 fig, 1 tab, 24 ref. National Foundation Grant G-24043.

Descriptors: *Physiological ecology, *Metabolism, *Water balance, Osmotic pressure, Ureas, Urine, Mammals.
Identifiers: *Bats, *Kidneys, *Henle's loops, *Urine concentrating mechanisms, Blood.

The diet of blood of the vampire bat is about 80 percent water and 20 percent protein. The high protein intake ensures a high urea production. In one meal the bat ingests a volume almost equal to its body weight. Aerodynamic considerations dictate a weight-lowering, and a copious, isotonic, low urea urine is excreted just after feeding onset. Since the bats do not drink free water, they must effect a highly concentrated urine when urea production begins. The kidneys of healthy bats were sectioned and microscopically examined for anatomical structures relevant to highly concentrated urea formation. The descending limb of Henle's Loop has specialized epithelial cells while the ascending limb is designed more simply--the opposite of what would be expected from current theories of kidney function. Vampire bats and kangaroo rats secrete urine of similar concentrations, but the bat has only one-third as many Henle's Loop cells, indicating much greater efficiency in individual cells. The vampire bat therefore confronts and solves water problems much like desert animals. (Casey-Arizona)
W70-09969

2J. Erosion and Sedimentation

TIN AND ZIRCONIUM IN THE SEDIMENTS AROUND THE BRITISH ISLES: A PRELIMINARY RECONNAISSANCE,
Carleton Univ., Ottawa (Ontario). Dept. of Geology; and Reading Univ. (England). Sedimentology Research Lab.
Patrick Arthur Hill, and Andrew Parker.
Economic Geology, Vol 65, No 4, p 409-416, June-July 1970. 8 p, 5 fig, 33 ref, append.

Descriptors: *Bottom sediments, *Beaches, *Sands, *Placer mining, Dunes, Mineralogy, Exploration, X-ray analysis, Surveys, Mapping.
Identifiers: *Zirconium, *Tin, *British Isles.

X-ray fluorescence analysis of 183 samples of beach and offshore sediment (mostly sand) from the Bristol Channel, Devon and Cornwall, the English Channel, the North Sea, and the coast of Ireland, shows that economic deposits of detrital tim are unlikely to be found anywhere but on the beaches of Cornwall or along offshore river valleys and strand lines. Economic deposits of zircon, together with other detritals, may be present in the North Sea at Spurn Head and the Dogger Bank. (Knapp-USGS)
W70-09531

VARIATION OF CATION EXCHANGE CAPACITY AND RATE WITH PARTICLE SIZE IN STREAM SEDIMENT,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02K.
W70-09535

CONTEMPORARY DEPOSITIONAL ENVIRONMENTS OF THE OMO DELTA,
Chicago University, Ill. Dept. of Geography.
Karl W. Butzer.
Nature, Vol 226, No 5244, p 425-430, May 2, 1970. 6 p, 1 fig, 15 ref.

Descriptors: *Sedimentation, *Deposition (Sediments), *Deltas, *Lakes, Geomorphology, Flood plains, Bottom sediments, Paleoclimatology, Channels, Geology, Sediments.
Identifiers: Africa, Ethiopia, Lake Rudolph, Omo Delta, Omo River.

Geomorphological and sedimentological studies of depositional environments of the modern Omo River Delta and floodplain were made for understanding of the Pliocene to Pleistocene formations of the lower Omo Basin (southwestern Ethiopia). The lower Omo Basin has a semi-arid tropical climate. Mean annual precipitation is about 350 to 600 mm. Rainfall is lowest around the shores of Lake Rudolf (at 370m) and increases rapidly in the highlands along the northern peripheries of the basin. The Omo River is the only perennial stream of the Lower Omo Basin and of the entire Rudolf Basin. Active sedimentation is optimal today in the lowland plains on floodplains, deltas, mudflats and in littoral situations. The standing waters of interdistributary basins and bays, of the open prodeltaic environment, of the lagoonal flats, or of the seasonally flooded plains can produce remarkably similar sediments. Differences and distinctions must be deduced from bedding properties, oxidation, evaporites, vertical and horizontal development, and geomorphological settings. It is necessary to interpret sedimentary sequences with great care, with reference to strictly defined concepts, and if possible with respect to modern depositional counterparts. (Knapp-USGS)
W70-09542

FIELD METHODS FOR MEASUREMENT OF FLUVIAL SEDIMENT,
Geological Survey, Washington, D.C.
Harold P. Guy, and Vernon W. Norman.
For sale by Superintendent of Documents, U S Government Printing Office, Wash, D.C. - 20402 - Price $0.70. U S Geological Survey Techniques of Water-Resources Investigations, Book 3, Chapter C2, 1970. 59 p, 29 fig, 3 tab, 57 ref.

Descriptors: *Sediments, *Sediment transport, *Sampling, *Measurement, *On-site data collections, Surveys, Investigations, Instrumentation, Sediment yield, Provenance, Particle size.
Identifiers: U S Geological Survey, Water resources investigations.

Field methods for the measurement of fluvial sediment are described. It is desirable that the persons involved in sediment measurements be familiar with the basic sediment concepts and the equipment and techniques to be used for making timely and efficient sediment measurements. The characteristics and limitations of commonly used samplers and some of the modifications of this equipment for special measurements are described. The characteristics of measurement sites, the selection of sampling vertical and transit rates, the methods of making sediment-discharge measurements, sampling quality control and timing, and some of the requirements for sediment-related data are discussed. (Knapp-USGS)
W70-09550

SEDIMENTATION, ANNOTATED BIBLIOGRAPHY OF FOREIGN LITERATURE, 1967-1968 SURVEY NO 5.
Department of Agriculture, Washington, D.C.; and National Science Foundation, Washington, D.C.

Available from NTIS, Springfield, Va. as TT 69-55007, $3.00 in paper copy, $0.65 in microfiche. Jerusalem, Israel Program for Scientific Translations, Ltd, 1969. 395 p.

Descriptors: *Bibliographies, *Sedimentation, *Foreign research, *Abstracts, Publications, Sediment transport, Deposition (Sediments), Erosion, Sedimentology.
Identifiers: Sedimentation bibliography.

The fifth volume of the annotated bibliography of foreign literature on sedimentation contains 1158 entries covering literature published outside the English-speaking world. The entries are arranged alphabetically by author, and a subject index is provided. This volume comprises material covering the years 1967-1968; an additional cumulative subject index covers the preceding volumes. The literature survey covered mainly periodicals, but also monographs, individual pamphlets and collected papers. The sources used were available at scientific and technical libraries in Israel, and special subscriptions were entered for a number of additional periodicals. The source languages for this issue

were: Armenian, Azerbaijani, Belorussian, Bulgarian, Czech, Dutch, English, Flemish, French, Georgian, German, Greek, Hebrew, Hungarian, Italian, Japanese, Lithuanian, Mongolian, Norwegian, Polish, Portuguese, Rumanian, Russian, Serbo-Croat, Slovak, Spanish, Swedish, Turkish, and Ukrainian. (Knapp-USGS)
W70-09556

THE RELATIONS OF HYDROLOGY AND GEOMORPHOLOGY IN A HUMID TROPICAL STREAM BASIN - THE RIO GRANDE DE MANATI, PUERTO RICO,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
For primary bibliographic entry see Field 02E.
W70-09566

MAGNITUDE OF WAVES ON LAKE BUTTE DES MORTS AND THEIR EFFECT ON LAKE DEPTH AND SEDIMENT DISTRIBUTION,
Wisconsin State Univ., Oshkoch. Limnology Lab.
For primary bibliographic entry see Field 02H.
W70-09672

DEPOSITIONAL ENVIRONMENTS OF LAKE SUPERIOR SANDS THROUGH GRAIN SIZE ANALYSIS,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
Albert B. Dickas.
Available from the NTIS as PB-194 029, $3.00 in paper copy, $0.65 in microfiche. Center for Lake Superior Environmental Studies, Contribution No 15 (1970). 16 p, 1 tab, 5 fig. OWRR A-023-WISC (3).

Descriptors: *Particle size, *Sediments, *Lake Superior, Wisconsin, Rain, Littoral, Neritic, *Deposition (Sediments), Lake soils.
Identifiers: Pales-environments, Phi deviation.

As part of the problem of recognizing and reconstructing paleo-environments of arenaceous units in western Lake Superior, grain size parameters of modern fluvial, littoral and inner neritic lake sediments have been analyzed. Similar studies are reported from other geographic areas. While environmental field boundaries are of certain of these studies are curved and ill defined, other boundaries are differentiated on a linear basis, the system employed here due to the ease with which such a boundary is defined. Of all available graphs, that of phi deviation versus the diameter was found to be the most successful as it correctly classified 87.6 percent of all samples into a fluvial and a non-fluvial field. Further differentiation of non fluvial fields is displayed. While the method presented here is quite functional, correlation with other studies indicated that differing lines of separation between genetic fields must be determined on the local geographic level as predetermined by depositional energy factors. (See also W70-09674)
W70-09673

SEDIMENTS AND GEOLOGY OF BOIS BRULE RIVER, WESTERN LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
Albert B. Dickas, and Paul C. Tychsen.
Reprint from Proceedings, 12th Conference Great Lakes Research, International Association of Great Lakes Research, p 161-169, 1969. 6 fig, 10 ref. OWRR A-023-WISC (6).

Descriptors: *Sediments, *Bed load, *Geology, *Particle size, Lake Superior, Wisconsin.
Identifiers: *Clastic material, Bois Brule River, Glacial cover.

A sedimentary analysis was made of the bed load (i.e. traction load) of the Bois Brule River, Douglas County, Wisconsin to better understand the statistical characteristics of the clastic material being transported by this stream and its contribution to the Holocene sedimentation history of the Wisconsin shoreline of Lake Superior. In addition, bedrock and glacial deposits were mapped throughout the drainage basin. The average mean size distribution of the clastic load, based on the phi scale, is as follows: 10% granules, 74% sand, 13% silt and 3% clay. To determine whether this dominantly sand-sized sediment was derived from basement rock or glacial debris, stream gravels larger than granule size were petrographically analyzed and compared to surficial and basement rock maps. Results indicate that the glacial cover is the prime source of the clastic material of the river load, concurring with the mapping program which shows that outwash sands and reworked glacial drift predominate over much of the drainage area. A secondary source is outcropping Keweenawan (Cambrian) sandstones. Earlier studies indicate the river load is deposited in Lake Superior out to a distance of 1/2 - 1 mile from the shoreline with the finer material found at the greater distance from the littoral zone. (See also W70-09767)
W70-09675

HYDRODYNAMIC MODEL OF THE BLAKE OUTER RIDGE,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 02L.
W70-09688

THE COLUMBIA RIVER AS A SOURCE OF MARINE LIGHT-SCATTERING PARTICLES,
Oregon State Univ., Corvallis. Dept. of Oceanography.
Hasong Pak, George F. Beardsley, Jr., and P. Kilho Park.
Journal of Geophysical Research, Vol 75, No 24, p 4570-4578, August 20, 1970. 9 p, 8 fig, 17 ref. ONR Contract N00014-67-A-0369-0007.

Descriptors: *Suspended load, *Columbia River, *Turbidity, *Light penetration, Optical properties, Surveys, Suspension, Turbidity currents, Water quality, Continental slope.
Identifiers: *Light scattering.

The Columbia River plume region was investigated from June 20, to July 3, 1968 by light-scattering measurements and standard hydrographic station observations. The Columbia River plume was traced for 200 km by the light-scattering particles in the plume water. The scatterers are estimated to be contained in the plume water for at least 30 days. The observed distribution of particles indicates a northward deep current under the plume near the river mouth, a subsurface offshore flow near the bottom of the plume along the northern Oregon coast, and a major surface flow to the south and southwest. (Knapp-USGS)
W70-09690

EVALUATION OF GRAIN-SIZE PARAMETERS IN LACUSTRINE ENVIRONMENTS,
Computer Data Processors Ltd., Calgary (Alberta); and Calgary Univ. (Alberta). Dept. of Geology.
J. T. Solohub, and J. E. Klovan.
Journal of Sedimentary Petrology, Vol 40, No 1, p 81-101, March 1970. 21 p, 11 fig, 1 tab, 18 ref.

Descriptors: *Particle size, *Sedimentation, *Lakes, *Statistical methods, Regression analysis, Correlation analysis, Deposition (Sediments).
Identifiers: Factor analysis, Sedimentary environments, Depositional environments.

Using an area of recent lacustrine sedimentation as a reference model, several methods of treating grain-size distribution of sands were evaluated for their ability to discriminate between or identify, depositional environments. The techniques of Passega (1957), Mason and Folk (1958), Friedman (1961), Sahu (1964), and Klovan (1966) were applied to sediment samples from known depositional settings. Of the methods, only factor analysis (Klovan, 1966) produced mappable results consistent with known energy conditions at the depositional sites. The lack of success of the methods may result from any or all of the following factors: (1) Standard bivariate plots cannot adequately express the complex processes producing particular grain-size distributions. (2) Grain-size parameters are merely descriptors of grain-size distributions. As such they may not contain all available information, nor perhaps of the right kind, to enable environmental determination. (3) Combinations of amount and type of kinetic energy (which may be primarily responsible for the grain-size distribution of a sand) may produce similar distributions in different environments. The hypothesis that grain-size distributions can identify depositional environments is probably not universally valid. It is concluded that grain-size distributions reflect depositional processes rather than environment and that the two need not be the same. (Knapp-USGS)
W70-09693

AN EXACT METHOD FOR CHARACTERIZATION OF GRAIN SHAPE,
Michigan State Univ., East Lansing. Dept. of Geology; and Michigan State Univ., East Lansing. Dept. of Computer Science.
Robert Ehrlich, and Bernhard Weinberg.
Journal of Sedimentary Petrology, Vol 40, No 1, p 205-212, March 1970. 8 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Particle shape, *Statistical methods, *Fourier analysis, Sedimentation, Analytical techniques, Sedimentology.
Identifiers: Particle shape classification.

Grain shape may be described as precisely as needed by Fourier series expansion of the radius about the center of mass utilizing coordinates of peripheral points. Empirical results of grains from typical samples indicate that the series contains, in partitioned from, a large amount of geologically interesting information. Consequently, previous subjective evaluations of the worth of shape variations in the solution of geologic problems are justified. The shape variable is amendable to semiquantitative graphical evaluation or may be used as data for multivariate analytical schemes. Illustrative examples show that the shape variables easily discriminate grain differences arising from geographic, stratigraphic, and process factors. (Knapp-USGS)
W70-09697

BOTTOM SEDIMENTS OF LAKE MANAZALAH, EGYPT,
Alexandria Univ. (Egypt). Dept. of Oceanography; and Institute of Oceanography, Alexandria (Egypt).
For primary bibliographic entry see Field 02H.
W70-09699

THE KARST LANDSCAPE OF YUCATAN,
National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program.
William A. Finch, Jr.
Report available from NTIS as AD-679 464, $3.00 in paper copy, $0.65 in microfiche. Report 1968. 169 p, 41 fig, 16 tab, 70 ref, 3 append. ONR Contract N00014-67-A-0244-0001 NR 389-105 Subcontract No 79.

Descriptors: *Karst, *Geomorphology, Groundwater movement, Caves, Topography, Tropical regions, Humid areas, Wet climates, Limestones, Drainage effects, Drainage patterns (Geologic), Subsurface drainage.
Identifiers: Mexico, Yucatan.

A descriptive regional analysis was made of the physical aspects of Yicatan's karst landscape. Different types of karst land forms characterize individual types of horizontal limestone which underlies Yucatan. Distinctive microenvironments

characterize the individual types of karst land forms. Distinctive floristic communities are associated with these micorenvironments. The areal distribution of the different types of karst land forms yields a pattern which provides the regional framework used in this study. Three regions occur in Yucatan's karst landscape. Each region possesses a distinctive karst land form assemblage. These are (1) The Coastal Karst Region where fresh water springs flow from underground fissures creating less saline environments in the normally saline barrier beach, lagoon, and mangrove environments; (2) The Central Karst Region where cenotes, aguadas, and dolines are the common karst land forms; and (3) The Hill Karst Region where occur a multitude of caves. Appendices include a brief survey of karst literature, representative climatic data for Yucatan, and a selected glossary of Maya and Spanish landscape terminology. (Knapp-USGS)
W70-09707

ABOUT TURBULENT DIFFUSION OF SUSPENDED PARTICLES IN FLUID FLOW,
V. S. Sineltshikov.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D5, p 42-46, 1967. 5 p, 9 ref.

Descriptors: *Suspension, *Settling velocity, *Aeration, Hydrodynamics, Bubbles, Flow, Mixing, Air entrainment, Mathematical studies, Sediment transport.
Identifiers: Two phase flow.

Distribution of suspended particles with high magnitude of fall velocity is analyzed by hydrodynamical methods. The distribution of these particles is found to be similar to that of ideal gas molecules or Brownian particles in the field of gravity. The results obtained are used to describe air-bubbles distribution in aerated flow. (Knapp-USGS)
W70-09737

SOME STATISTICAL PROPERTIES OF DENDRITIC CHANNEL NETWORKS,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02E.
W70-09843

EFFECT OF PARTICLE SIZES TO TURBULENT DIFFUSIVE PROCESSES IN FREE SURFACE FLOW,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09861

MEASUREMENTS OF THE INFLUENCE OF SUSPENDED PARTICLES ON THE SIZE OF VORTICES,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau und Erdbau.
For primary bibliographic entry see Field 08B.
W70-09862

USE OF RADIOISOTOPES IN SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
G. Courtois.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/9, p 117-165, 1967. 49 p, append, 262 ref.

Descriptors: *Tracers, *Tracking techniques, *Radioisotopes, *Sediment transport, *Reviews, Bibliographies, Sediment load, Sedimentology, Radioactivity techniques, Bed load, Suspended load, Sampling.
Identifiers: Sediment tracing.

Radioisotopes have two main uses in sedimentology: they are used for the study of sediment movements in rivers and seas, and for continuous measurements of the amount of sediment suspended in a given medium. The technical aspects of using artifical tracers include the choice of radioisotope, surface and mass labelling (with particular reference to the problem of silting), immersion and detection equipment, and problems of navigation and topographical reference points. The problem of obtaining quantitative results is discussed and the proposed methods are described. The methods described may also be applied to related problems of considerable importance (soil erosion, soil stabilization and the movement of sand dunes) and brief references are made to these problems. Since the transport of suspended solids is generally much more significant than bed-load movement, continuous measurements are of great importance. A number of examples are given of the value of information obtained by such measurements. Other radioisotope techniques which may also be used in sedimentology are dating, analytical studies (either continuous analysis of core samples by means of X-ray flourescence or the detection of trace elements by activation analysis), use of tracers, for example for the study of particle movements when affected by freezing of the soil or for the study of the formation and precipitation of sediment as a function of the physico-chemical characteristics of the waterbody, and measurements of sediment density by means of back-scattering gages. A bibliography of 262 references is included. (See also W70-09868) (Knapp-USGS)
W70-09875

RADIOISOTOPE TECHNIQUES FOR DETERMING SILT MOVEMENT FROM SPOIL GROUNDS IN THE FIRTH OF FORTH,
Atomic Energy Research Establishment, Wantage (England). Research Lab.
D. B. Smith, and T. V. Parsons.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/11, p 167-180, 1967. 14 p, 7 fig, 5 ref.

Descriptors: *Sediment transport, *Silts, *Tracers, *Tracking techniques, *Dredging, Waste disposal, Path of pollutants, Radioisotopes, Radioactivity techniques, Topography, Bed load, Suspended load, Estuaries, Currents (Water).
Identifiers: Dredging spoil.

The techniques used in a series of investigations into silt movement from spoil grounds in the Forth estuary are described. The tracers used were Sc-46 and La-140, incorporated in ground glass which was distributed in spoil in a hopper and deposited to stimulate normal dredging practice. Qualitative tracer movement was measured in the estuary and quantitative values were obtained in a dockyard by measurement of the vertical distribution of the tracer. The extensive upstream movement of spoil from the normal area of deposition showed that it was an economically unsatisfactory spoil ground. An alternative area was selected by study of the topography of the estuary bed and the prediction of downstream silt movement from this area was confirmed by tracer studies. (See also W70-09868) (Knapp-USGS)
W70-09876

QUANTITATIVE MEASUREMENT OF MARITIME SEDIMENT MOVEMENT USING RADIOACTIVE TRACERS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 02L.
W70-09877

PERFORMANCE OF NUCLEAR-SEDIMENT CONCENTRATION GAUGES,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 07B.
W70-09879

SURFACE LABELLING OF SAND WITH Cr-51 BY THERMAL DECOMPOSITION OF AMMONIUM DICHROMATE Cr-51,
Australian Atomic Energy Commission, Sutherland (Australia).
B. L. Campbell, and B. W. Seatonberry.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No Sm-83/15, p 227-232, 1967. 6 p, 2 fig, 10 ref.

Descriptors: *Tracers, *Tagging, *Sands, *Tracking techniques, *Radioisotopes, Radioactivity techniques, Chromium, Chemical precipitation, Erosion, Sediment transport, Beaches, Littoral drift, Bed load.
Identifiers: Chromium radioisotopes.

A new and efficient method for labelling sand with multicurie amounts of Cr-51 is described. It is based on the formation of chromic oxide when ammonium dichromate is thermally decomposed. The technique has been used successfully with silica sand from Botany Bay, N. S.W. The ammonium dichromate is intimately mixed with the sand and then decomposed by raising the temperature while keeping the mass stirred. About 70% of the chromic oxide adheres to the sand. The radioactive label is stable over long periods of immersion in sea water and is resistant to the type of abrasion which can occur in sand-tracing experiments. The application of this method to the production of 25-kg batches of labelled sand is described. It is possible that the method could be applied to other granular solids which are stable up to 400 deg C. (See also W70-09868) (Knapp-USGS)
W70-09880

SURFACE DEPOSITION OF RADIOISOTOPES ON SAND AND SILTS (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
H. Bougault, A. Caillot, G. Courtois, and B. Jeanneau.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/16, p 233-262, 1967. 30 p, 11 fig, 3 tab, 6 ref.

Descriptors: *Tagging, *Sands, *Silts, *Tracers, Sediment transport, Gold radioisotopes, Chromium, Radioisotopes, Radioactivity techniques, Chemical precipitation, Bed load, Suspended load, Tracking techniques.
Identifiers: Chromium radioisotopes.

There are two major methods of using radioisotopes to study sedimentary movements. In mass-labelling, the sediment is replaced by a glass containing an element that can be activated, and in surface labelling, a physico-chemical treatment makes it possible to deposit a radioisotope on the surface of the sediment. Surface labelling is used mainly for sands, when a large number of labelled particles is necessary (for statistical purposes); and for silts, when it is necessary to retain the features associated with their dynamic properties. Simple and rapid methods of labelling were developed to be applied at the site of the experiment by persons possessing only limited equipment for handling radioisotopes. The process recommended for labelling sands by using Au-198 is a combination of the Petersen method (treatment with tin chloride) and that of Campbell (treatment with silver) after pre-treatment with nitric acid and soda. By this method, it is possible to deposit 125 mg of gold per kilogram of sediment with an efficiency of 95%.

For marking sands with Cr-51 a film of silica gel is first deposited and radioactive lead chromate is then adsorbed on to it. In this way, 500 mg of chromium per kilogram of sand can be fixed with more than 90% efficiency. The labelling of silts by using Au-198 is achieved with a neutralized chlorauric acid solution. The gold is reduced on contact with the silt on which it is fixed. Ten Ci/kg of sediment can be fixed with 100% efficiency. (See also W70-09868) (Knapp-USGS)
W70-09881

INVESTIGATION INTO THE MOVEMENT OF FLUVIAL BED-LOAD WITH RADIOISOTOPES,
Research Inst. for Water Resources Development, Budapest (Hungary).
Zs. Erdelyszky, and K. Stelczer.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/18, p 263-269, 1967. 7 p, 3 fig, 2 tab, 2 ref.

Descriptors: *Sediment transport, *Abrasion, *Tracers, *Tracking techniques, Radioactivity techniques, Radioisotopes, Sands, Bed load, Particle size.
Identifiers: Bed load tracers.

A new method was devised for determining the abrasion of sediment grains under natural conditions. Similarly marked gravels of different specrum energy corresponding to different diameters were put into the water at a certain point in the Danube after which they were followed with a special nuclear device prepared for this purpose, so that the grains of the sediment could be separated according to their diameters. (See also W70-09868) (Knapp-USGS)
W70-09882

A CONTRIBUTION TO THE KINETIC THEORY OF BED-MATERIAL DISCHARGE,
Institut za Vodoprivredu Jaroslav Cerni, Belgrade (Yugoslavia).
P. Todorovic, V. Vukmirovic, R. Vukotic, and A. Filip.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/19, p 271-290, 1967. 20 p, 8 fig, 1 tab, 6 ref.

Descriptors: *Sediment transport, *Bed load, *Tracers, *Tracking techniques, Radioactivity techniques, Radioisotopes, Stochastic processes, Statistical methods, Mathematical studies.
Identifiers: *Yugoslavia, Danube River.

Investigations of fundamental kinetic characteristics of bed-material discharge can be carried out by means of radioactive tracers. Tracer experiments were accomplished on the Danube and Velika Morava Rivers, and were supported by the International Atomic Energy Agency. A theoretical base is given for the study of the kinetic characteristics of bed-material discharge. Practical applications of the results are discussed. Theoretically, the problem of bed-material discharge was considered as a stochastic process. (See also W70-09868) (Knapp-USGS)
W70-09883

EROSION BY RAIN IN THE WESTERN CONGO (FRENCH),
Universite Lovanium de Kinshasa (Congo).
J. de Ploey.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy andGeophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/14, p 291-301, 1967. 11p, 7 fig, 8 ref.

Descriptors: *Soil erosion, *Sands, *Impact (Rainfall), *Tracers, *Radioactivity techniques, Tracking techniques, Radioisotopes, Rainfall-runoff relationships, Grasslands.
Identifiers: Congo.

Vast expanses of the western part of central and southern Africa are covered with uniform, sandy formations of the Kalahari type. The topography of these areas and their present morphological characteristics are mainly the result of erosion by rain. Information on the hydrology of the surface waters in these areas is fairly limited and is insufficient to permit any conclusion regarding the way in which erosion by rain takes place. To obtain a better understanding of these phenomena, Sc-46 labelled radioactive sand was used to trace rain erosion. Series of labelled samples were placed successively on the surface of the experimental plot and the erosive effect of rain was determined by measuring the residual concentrations after rainfall. Some samples were placed below a shield so as to eliminate the effects of splash and reveal the part played by runoff. Radiographic films were used to study the dispersion of labelled particles in the surrounding area. This radiographic method made it possible to determine the scale of erosion by splash for different rainfall conditions. Erosion by rain on Kalahari ground covered with sub-steppe savannah is caused mainly by splash erosion and by dispersed, intermittent runoff. Sheet-wash plays no part if the slope is less than 12 deg. (See also W70-09868) (Knapp-USGS)
W70-09884

LOESS--THE YELLOW EARTH,
Leeds Univ. (England); and BISRA-The Inter-Group Labs. of British Steel Corp., London (England).
I. J. Smalley, and R. L. S. Taylor.
Science Journal, Vol 6, No 2, p 28-34, Feb 1970. 7 p, 9 fig.

Descriptors: *Loess, *Deposition (Sediments), Soil types, Soils, *Soil formation, Soil structure, Soil stability, Soil erosion, *Aeolian soils, Finegrained soils, Geographical regions, Soil properties, Agriculture.
Identifiers: Soil maps, *Soil deposits.

Loess, an extremely fine earth formed by aeolian deposition, covers vast tracts of the world's land surface, sometimes to the depth of 100 m. Loess is an excellent agricultural soil and has had considerable influence on the development of civilization. Several theories of deposition and formation of loess particles are discussed. Glaciers are suggested as the main producers of loess material. When a glacier melts, a load of detritus containing 2 distinct sizes of quartz particles is deposited. Separation of fine particles and deposition as homogeneous deposits some distance away provide the sediments called loess. The fine particles are lifted by the wind, the nature of the transported material being controlled by a lift factor and a carry factor. Very small particles cohere tightly and large particles are too heavy to move. The wind lifts most efficiently particles having diameters of about 0.08 mm (the lift factor). The critical particle size above which particles are not carried by the wind in suspension is about 0.2 mm (the carry factor). In this way, the lift factor imposes limits on the eventual loess deposit, and the carry factor reinforces the limits. Once deposited, the relatively high cohesive forces keep the loess stable and erosion occurs only if the material is disturbed. (USBR)
W70-09909

TESTS OF THEORETICAL CALCULATIONS OF DISCHARGES OF SUSPENDED SEDIMENT IN PLAINS RIVERS,
K. V. Razumikhina.
Tr Gos Gidrol Inst No 156, p 31-38, 1968. Bur Reclam Transl 828, Jan 1970. 18 p, 4 fig, 4 tab, 8 ref.

Descriptors: *Fluvial hydraulics, Foreign research, Mathematical analysis, *Suspended sediments, River flow, Sediment transport, Chezy equation, *Sediment discharge, Streamflow records, *Turbidity, *Rivers, Roughness (Hydraulic), Grain sizes, Reservoirs, *Bottom sediments, Flood plains, Hydrographs, Discharge (Water), Streambeds, *Sedimentation.
Identifiers: USSR, High flow, Flood stages.

Formulas are presented for computing the discharge of suspended sediment in plains rivers. The formulas relate the turbidity of the flow to the sediment discharge through computation of scour turbidity (related to streamflow characteristics) and a hydromechanical sediment parameter (related to sediment composition and streamflow characteristics). Granular roughness of the streambed is determined by analysis of particle size. Computed and measured values of the sediment discharge are compared for various phases of the flow regime, including low flows and spring floods. The relationship between measured river discharge and suspended discharge depends on river characteristics; the rivers studied are classed into 3 groups. Recommendations for application of the formulas and the limits of applicability are discussed. (USBR)
W70-09910

2K. Chemical Processes

THE APPLICATION OF LASER IONIZATION MASS SPECTROMETRY TO THE IDENTIFICATION OF ORGANIC SALTS IN POLLUTED WATER,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 05A.
W70-09522

ANALYSIS OF ORGANIC SALTS BY LASER IONIZATION,
Pennsylvania State Univ., University Park. Dept. of Materials Science.
For primary bibliographic entry see Field 05A.
W70-09523

TIN AND ZIRCONIUM IN THE SEDIMENTS AROUND THE BRITISH ISLES: A PRELIMINARY RECONNAISSANCE,
Carleton Univ., Ottawa (Ontario). Dept. of Geology; and Reading Univ. (England). Sedimentology Research Lab.
For primary bibliographic entry see Field 02J.
W70-09531

VARIATION OF CATION EXCHANGE CAPACITY AND RATE WITH PARTICLE SIZE IN STREAM SEDIMENT,
Geological Survey, Denver, Colo.
Ronald L. Malcolm, and V. C. Kennedy.
Journal Water Pollution Control Federation, Vol 42, No 5, Part 2, p R153-R160, May 1970. 8 p, 2 fig, 1 tab, 13 ref.

Descriptors: *Ion exchange, *Sediments, *Particle size, Bed load, Suspended load, Cation exchange, Gravels, Silts, Sands, Clays, Clay minerals, Sediment transport, Sedimentation, Water chemistry, Water quality, California.
Identifiers: Mattole River (Calif.).

A potassium specific-ion electrode was used to determine the rate of Ba-K/exchange and the cation exchange capacity (CEC) of the size-fractionated stream sediment from the Mattole River of northern California. The time required for 75 percent completion of exchange ranged from 3 sec for clay fractions to 12 hr for gravels. The average CEC of the clay, silt, sand, and gravel fractions were 37.6, 11.0, 9.7, and 7.2 meq/100 g, respectively. Organic matter contributed about 15 percent of the total cation-exchange capacity of the

sediment. The CEC of the sand and gravel fractions exclusive or organic matter were 5.5 to 8.0 meq/100 g; they must be included in a consideration of the total exchange, chemical properties, and transport phenomena of the stream. (Knapp-USGS)
W70-09535

CARBON AND OXYGEN ISOTOPE FRACTIONATION IN THE SKELETAL CARBONATE OF REEF-BUILDING CORALS,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
Jon N. Weber, and Peter M. J. Woodhead.
Chemical Geology, Vol 6, No 2, p 93-117, July 1970. 25 p, 3 fig, 5 tab, 81 ref. NSF Grant GA-1437.

Descriptors: *Stable isotopes, *Water chemistry, *Coral, *Calcium carbonate, Sediments, Provenance, Chemical precipitation, Carbon, Oxygen, Tracers, Tracking techniques, Mathematical models, Reefs, Carbonates, Limestones.
Identifiers: Isotope fractionation, Australia, Great Barrier Reef.

Study of geochemistry of carbonate sediments and carbonate rocks is aided by a detailed understanding of the isotopic composition of the various sediment contributors. The coelenterates are of particular interest in this respect because the stable isotope ratios of their skeletons are controlled by both vital and inorganic environmental factors. To determine the relative importance of these factors, 475 specimens in 50 genera were selected from the coral population of Heron Island on the Great Barrier Reef of Australia. The samples were taken from tow depth environments: (1) surface, defined as 0-4.6 m; and (2) 18 m. The observed range of C-13 variation is 1.3% with respect to PDB standard carbon dioxide; that of 0-18 is 0.4%. A MODEL INCORPORATING BOTH BIOLOGICAL AND ENVIRONMENTAL FACTORS WAS DEVELOPED TO ACCOUNT FOR ISOTOPE RATIO VARIATIONS IN COELENTERATE CARBONATE. The analytical data are consistent with the model. At a specific reef locality, the most important factors causing isotope ratio variations in the skeletal carbonate of corals are zooxanthellar activity and temperature. (Knapp-USGS)
W70-09545

THE OCCURRENCE OF THALLIUM IN SEA WATER AND MARINE SEDIMENTS,
Liverpool Univ. (England). Dept. of Oceanography.
A. D. Matthews, and J. P. Riley.
Chemical Geology, Vol 6, No 2, p 149-152, July 1970. 4 p, 2 tab, 6 ref.

Descriptors: *Trace elements, *Sea water, *Sediments, *Thallium radioisotopes, Neutron activation analysis, Sampling, Chemical analysis, Geochemistry, Water chemistry, Minerology, Clay minerals, Ion exchange, Adsorption.
Identifiers: Thallium.

The concentration of thallium in the water column at a station in the North Atlantic has been investigated using a neutron activation procedure. Values ranging from 9.4 - 16.6 ng/liter were found. Thallium has been determined in 11 deep sea sediments. Experiments suggest that the geochemical balance of the element in the oceans may be maintained by adsorption on the hydrous manganese dioxide phase of ferro-manganese minerals and by incorporation into the lattice of illite and similar clay minerals. (Knapp-USGS)
W70-09546

THE MOVEMENTS OF DIFFERENT SALT SOLUTIONS IN SOIL PROFILES,
Magyar Tudomanyos Akademia Talajtani es Agrokemiai Jutato Intezete, Budapest.
For primary bibliographic entry see Field 02G.
W70-09577

ON THE PROBLEM OF SALT DIFFUSION IN THE ZONE OF AERATION,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09578

VERTICAL DISTRIBUTION OF EXCHANGEABLE CATIONS IN SOILS OF ARID ZONES AS AN INDICATION TO THE DEPTH OF WATER INFILTRATION,
Egyptian Desert Inst., Cairo.
For primary bibliographic entry see Field 02G.
W70-09581

COMPARISON OF THE WATER QUALITY OF THE BOIS BRULE AND POPLAR RIVERS, WISCONSIN - BOTH TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 05A.
W70-09674

WATER-CLAY INTERACTIONS IN NORTH CAROLINA'S PAMLICO ESTUARY,
North Carolina Univ., Chapel Hill. Dept. of Geology; and North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 02L.
W70-09678

THE CHEMISTRY OF THE INTERSTITIAL WATER AS A MEASURE OF CONDITIONS IN A SANDY BEACH,
National Inst. for Water Research, Congella (South Africa).
For primary bibliographic entry see Field 05A.
W70-09679

APPLICATIONS OF FLUORESCENCE SPECTROSCOPY TO FUNDAMENTAL PROBLEMS IN INSECT BIOCHEMISTRY,
Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 05A.
W70-09682

DISPERSION OF NATURALLY OCCURRING IONS IN GROUNDWATER FROM VARIOUS ROCK TYPES IN A PORTION OF THE SAN PEDRO RIVER BASIN, ARIZONA,
Agricultural Research Service, Tucson, Ariz. Southwest Watershed Research Center.
D. E. Wallace, and L. R. Cooper.
Journal of Hydrology, Vol 10, No 4, p 391-405, June 1970. 15 p, 9 fig, 1 tab, 7 ref.

Descriptors: *Groundwater movement, *Water chemistry, *Dispersion, *Tracers, *Arizona, Solutes, Alluvium, Recharge, Discharge (Water), Flow nets, Leaching, Mixing, Ion transport, Ions.
Identifiers: San Pedro River basin (Ariz).

The groundwater in an alluvial basin in southern Arizona was analyzed for concentrations of Ca, Mg, Na, and Cl ions. The variety of rock types in the area, plus the undisturbed state of the groundwater basin, make comparative rock mineralization-groundwater ionization interpretations possible. Ionic dispersion in groundwater emanating from source areas composed of differing rock types is plotted as isogram maps. These isolated areas of differing mineral composition each exhibit a unique ionic contribution to groundwater. The ion concentrations in groundwater were then used as naturally occurring tracers to determine source areas of recharge and to delineate subsurface barriers to the normal basin flow net. Ion dispersion plots reveal the carbonates of the Dragoon Mountains to be a major contributor of Ca and Mg to the deep alluvial portion of the basin. Cl dispersion patterns show the granitic intrusives of the Tombstone Hills produce a barrier effect in the normal flow pattern of the basin as well as being a contributor of Cl to groundwater. (Knapp-USGS)
W70-09692

ANALYSIS OF MULTICOMPONENT ORGANIC MIXTURES IN AQUEOUS MEDIA BY PYROLYSIS,
Rocketdyne, Canoga Park, Calif. Research Div.
For primary bibliographic entry see Field 05A.
W70-09694

CHROMIUM SPECIATION IN SEA WATER,
Leeds Univ. (England).
H. Elderfield.
Earth and Planetary Science Letters, Vol 9, No 1, p 10-16, August 1970. 7 p, 4 tab, 22 ref.

Descriptors: *Chromium, *Sea water, Water chemistry, Trace elements, Chemical reactions, Oxidation-reduction potential, Chemical precipitation, Sedimentation.
Identifiers: Chromium ions (Sea water).

Comparison of an equilibrium model for Cr in sea water (and in marine sediments) with the real system has revealed a significant discrepancy in that the predicted Cr (III) concentration in sea water is considerably less than that actually found. While chemical thermodynamics can qualitatively describe possible Cr species in sea water, other parameters are also involved in controlling the Cr oxidation ratio. The slow oxidation rate of Cr (III) is suggested as being a likely causal factor. The reduction of Cr (VI) by organisms and/or organic matter should also be nonlabile but an organic factor cannot be completely ruled out since the mechanism of concentration of Cr by marine animals is unknown. (Knapp-USGS)
W70-09696

STUDY ON SALT WATER INTRUSION INTO GROUND WATER - PART 2. GEOCHEMICAL RESEARCH OF SALT GROUNDWATER (JAPANESE).
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
Kiyoji Ikeda.
Bulletin of Geological Survey of Japan, Vol 18, No 6, p 15 (393)-33 (411), June 1967. 19 p, 17 fig, 13 tab, 8 ref.

Descriptors: *Geochemistry, *Saline water intrusion, Groundwater, Aquifers, Ion exchange, Clay minerals, Leaching, Groundwater movement, Water chemistry, Path of Pollutants.
Identifiers: Japan, Fuji.

The Cl contents of coastal groundwater in Fuji city, Shizuoka prefecture, Japan have increased rapidly since 1960. The salt groundwater is mainly in the Fuji lava, and the salt-water zone has been widened rapidly. The chemical components of the salt groundwater are generally characterized as noncarbonate hardness type, and differ from those of sea water at the early stage of salting. Groundwater has: (1) higher Ca content; (2) slightly higher SO4 content; and (3) lower Na, K and HCO3 contents than the chemical components of sea water and groundwater proportionally mixed. Experimental results suggest that the change of chemical compositions at the early stage of salting is due to base-exchange and dissolution reaction between sea water and clay in the water-bearing layers. (See also W70-09732). (Knapp-USGS)
W70-09733

AN NMR STUDY OF THE PROTOLYSIS KINETICS OF SULFONAMIDES,
Georgia Univ., Athens. Dept. of Chemistry; and Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 05A.
W70-09770

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX B: PART I CHEMICAL REACTIONS BETWEEN ACID IN-

USTRIAL WASTES, FORMATION WATERS, ND MINERALS IN SALAQUIFERS OF LABAMA; PART II, LABORATORY STUDY F SELECTED RESERVOIR ROCKS,
labama Univ., University. Natural Resources enter.
or primary bibliographic entry see Field 05E.
70-09773

ODIFICATION OF THE ISOTOPIC COMOSITION OF RAINWATER BY PROCESSES HICH OCCUR BEFORE GROUNDWATER ECHARGE,
eizmann Inst. of Science, Rehovoth, (Israel).
R. Gat, and Y. Tzur.
: Isotopes in Hydrology, Proceedings Symposium International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, ov 14-18, 1966: International Atomic Energy gency STI/PUB/141, Vienna, Paper No SM-83/4, 49-60, 1967. 12 p, 3 fig, 22 ref.

escriptors: *Tracers, *Tracking techniques, Radioisotopes, *Stable isotopes, *Hydrologic cye, Deuterium, Tritium, Oxygen, Surface waters, roundwater movement, Precipitation (Atospheric), Evaporation, Evapotranspiration.
entifiers: Isotopic fractionation (Water).

he isotopic composition of groundwaters differs om that of the average rain composition due to lection (seasonal or otherwise) from among difrent rainfalls during the replenishment of groundaters, as well as to isotope fractionation in some f the steps in the recharge process. An assessment f the resulting concentration changes is required efore the characteristic variations of the isotopic omposition of atmospheric waters can be used as ydrological tracers of groundwaters. An over-all easure of the fractionation effect is obtained by omparison of the isotopic composition of rain and roundwaters in regions in Israel of known ydrological pattern and recharge areas. Correlaon of the effects with the areal environmental facors gives preliminary clues to the causes of fraconation. Of these the formation of puddles after ain seems particularly effective. Water-transport rocesses, which are steps in the rain-to-groundater transition, are evaluated regarding their otential contribution to the modification of the sotopic composition. They include interception by egetation, open-water evaporation and exchange ith ambient vapor from overland flow and surface unoff, evaporation of soil moisture, transpiration, nd water transport by unsaturated flow in the zone f aeration. (See also W70-09868) (Knapp-USGS) W70-09871

RAINOUT CHARACTERISTICS FOR HYDROLOGICAL STUDIES,
llinois State Water Survey, Urbana.
For primary bibliographic entry see Field 02A.
W70-09872

PHOTOSYNTHESIS AND ZONATION OF FRESHWATER MACROPHYTES,
Saint Andrews Univ. (Scotland). Dept. of Botany.
D. H. N. Spence, and Jean Chrystal.
New Phytologist, Vol 69, No 1, p 217-227, 1970. 2 fig, 30 ref.

Descriptors: *Photosynthesis, *Fresh water, Sun, Depth, Oxygen, Productivity, Light intensity, Chlorophyll, Energy, Carbon dioxide, Respiration, Mathematical models.
Identifiers: *Macrophytes, Shade, Potamogeton polygonifolius, Potamogeton obtusifolius, Leaf area, Leaf thickness.

The photosynthetic response of leaves produced in a glasshouse under both sun and shade conditions, from two species rooted in different depths of water is compared. There are significant, inherent differences in morphological and photosynthetic responses to light of 'sun' species of Potamogeton obtusifolius leaves (mean water depth 130 centimeters) and Potamogeton polygonifolius 'shade' species (mean depth 9 centimeters). Potamogeton obtusifolius has a rather similar photochemical capacity to P polygonifolius but has a lower energy yield value. It is concluded that a higher net photosynthetic capacity of this shade species in low irradiance such as 1% daylight must be achieved by reduction in respiration rate per unit area and leaf thickness, and increases in specific leaf area. Perhaps lowered respiration rate is partially a consequence of reduction in leaf weight/unit area and in ratio of non-assimilatory to assimilatory tissue; these factors may balance reduced light absorption by the thinner leaf. It is suggested that the limitation of net photosynthesis in shade species at levels of irradiance in which sun species are not limited, is related in a species like Potamogeton obtusifolius to its inability to reduce specific leaf area, thicken leaves and thus increase its capacity to absorb light. (Jones-Wisconsin)
W70-09888

PHOSPHORUS REQUIREMENTS OF TWO PLANKTONIC DIATOMS IN STEADY STATE CULTURE,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Edward J. Carpenter.
Journal of Phycology, Vol 6, p 28-30, 1970. 1 fig, 1 tab, 12 ref.

Descriptors: *Phosphorus, *Nutrient requirements, *Plankton, *Diatoms, *Cultures, Temperature, Light intensity, Hydrogen ion concentration, Carbon dioxide, Laboratory tests.
Identifiers: *Steady state, Cylindrotheca closterium, Nitzschia, Cyclotella nana, Chemostat.

Investigations on algal phosphorus requirements were carried out in batch culture systems in which conditions existing in nature are not approached due to unnatural increases in algal metabolites, changes in pH and carbon dioxide concentration, and lack of fresh nutrient input. The chemostat, a continuous-flow open system, can eliminate or reduce some of these limitations because new medium is continually introduced to the culture vessel and a suspension of algae and new and old media continually exists. Application of the chemostat is described in determining the limiting phosphorus requirements, at one growth rate, of two planktonic marine diatoms. Minimum phosphorus requirements of Cylindrotheca (Nitzschia) closterium and Cyclotella nana, were measured in axenic steady state chemostat culture. C closterium and C nana required 1.055 and 1.045 temto gramatoms phosphorus/cell per generation of 0.20 divisions/day. Algae were cultured at 15.5C and exposed to 5380 lux on a light-dark cycle of 19 and 5 hours. Phosphorus requirement/unit of cell volume was 0.0135 and 0.0129 temto gram-atoms phosphorus per cubic micron of cell volume for C closterium and C nana, respectively. (Jones-Wisconsin)
W70-09896

TRANSFORMATION OF RIVER WATER AT THE MOUTH OF A RIVER AND SOME CRITERIA OF POLLUTION,
State Oceanographic Inst., Moscow (USSR).
A. Simonov.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 4 p.

Descriptors: *Water pollution, *Rivers, Sewage disposal, Sewage treatment, Mathematical model, Salinity, Flows, Currents (Water).
Identifiers: *Criteria, *Marine discharge.

Results are given for theoretical and experimental hydrological-hydrochemical investigations of the transformation of river water into sea water at the mouth of several rivers of the U.S.S.R. The studies are concerned with the main features of exchange mechanism of physical and chemical characteristics at the dividing zone of the river and sea water at the mouth where there are no marked tidal phenomena. The current velocity any distance from the river, at the mouth, depends on the velocity of the river mouth, on the depth and on a parameter taking into account the actual physical and chemical exchange conditions. Decreasing current velocity of the flow is characterized by the satisfaction of a negative exponent. The equation of the water discharge for flow currents over the increasing depths obeys the exponential law and depends on the water discharge in the river mouth, on the depth and on the exchange conditions in the dividing area. The equations of water discharge and velocity of flow current are the main equations for estimating the distribution of other hydrological and hydrochemical characteristics of the mouth. The flow current water salinity with little wind increases sharply at the beginning of mixing then its rate of increase gradually decreases at some distance from the lower cross section of the river. Equations are derived for estimating a mean concentration of the main salt components and artificial admixtures. (Hancuff-Texas)
W70-09946

2L. Estuaries

THE SIGNIFICANCE OF DDT RESIDUES IN ESTUARINE FAUNA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
For primary bibliographic entry see Field 05A.
W70-09564

THE MATHEMATICAL MODELING OF A STRATIFIED ESTUARY,
Imperial Chemical Industries Ltd., Billingham (England). Heavy Organic Chemical Div.
G. D. Hobbs.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 6 p, 15 ref.

Descriptors: *Density stratification, *Mathematical models, *Estuaries, *Water quality, Saline-water-Freshwater interfaces, Mass transfer, Mixing, Tidal effects, Rivers, Hydrodynamic, Water chemistry, Diffusion.
Identifiers: Radioactive tracers.

The application was investigated of one- and two-dimensional mathematical models to the prediction of water quality in the estuary of the River Tees, a partially-mixed estuary suffering pollution from industrial waste water and domestic sewage. The one-dimensional model implied that all quantities of interest can be regarded as varying only with position along the river. This type of description is of most value for shallow freshwater streams and estuaries of the well-mixed type. The two dimensions under consideration were length and depth. A two-dimensional description will be of most value for partially stratified estuaries in which quantities varying significantly but smoothly over the depth. The relation of this work to the development of a complete model, incorporating both the hydrodynamics and the biochemistry, and verified against field data is briefly discussed. (Hsieh-Vanderbilt)
W70-09607

COOLING WATER OUTLET IN A STRATIFIED RECIPIENT,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden).
For primary bibliographic entry see Field 05C.
W70-09609

WATER-CLAY INTERACTIONS IN NORTH CAROLINA'S PAMLICO ESTUARY,
North Carolina Univ., Chapel Hill. Dept. of Geology; and North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
David A. Dobbins, Paul C. Ragland, and J. Donald Johnson.

Environmental Science and Technology, Vol 4, No 9, p 743-748, September 1970. 6 p, 6 fig, 5 tab, 22 ref.

Descriptors: *Estuaries, *Water chemistry, *Clay minerals, *North Carolina, Ion exchange, Cation adsorption, Saline water systems, Mixing, Saline water-freshwater interfaces, Connate water, Bottom sediments.
Identifiers: Pamlico Estuary (N C).

A natural estuarine environment was examined to show the chemical relationship between various waters and sediments. The pore to bottom water ratio of cationic equivalents measured at 20 stations increases systematically downstream from about 0.6 to 1.2 along the 50-mile profile in North Carolina's Pamlico River estuary. This trend is apparently controlled by entrapment of relatively saline water after northeasterly storms as the suspended load settles. Cationic concentrations generally decrease in the pore waters with depth, from a maximum 10-20 cm beneath the sediment-water interface. An increase of K equivalent ionic fraction in the pore waters with depth may be related to H ion exchange with the sediments. A strong correlation between exchangeable Mg and chlorite, as well as exchangeable K and illite, was noted. The ionic data are related to changes in the natural system and not to contamination by municipal wastes. (Knapp-USGS)
W70-09678

HYDRODYNAMIC MODEL OF THE BLAKE OUTER RIDGE,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
George M. Bryan.
Journal of Geophysical Research, Vol 75, No 24, p 4530-4537, August 20, 1970. 8 p, 9 fig, 16 ref. Naval Ships Systems Command Contracts NO bsr 85077 and N00024-67-C-1186.

Descriptors: *Sedimentation, *Continental shelf, *Florida, *Continental slope, *Marine geology, Oceans, Atlantic Ocean, Ocean currents, Currents (Water), Computer models, Model studies, Mathematical models, Topography, Deposition (Sediments), Hydrodynamics.
Identifiers: Blake Plateau, Blake Outer Ridge.

Formation of the Blake outer ridge by differential deposition of sediment on a relatively flat-lying floor (horizon A) is discussed on the basis of the hydrodynamic interaction of two oppositely directed currents, which are decelerated in the interaction zone and diverted to a final direction taken to be the trend of the Blake outer ridge. If one or both of the currents carry sediment, deposition occurs preferentially in the region of decelerated flow, so that sediment distribution is governed by the steady-state velocity field. Streamlines and isotachs computed from a model of two-dimensional streamline flow are found to be consistent with the known sediment distribution; they require upstream current widths in substantial agreement with estimated widths of the Florida Current and the Western Boundary Undercurrent. The Florida Current contributes relatively coarse sediment; the undercurrent, very fine sediment. (Knapp-USGS)
W70-09688

STUDY ON SALT WATER INTRUSION INTO GROUNDWATER - PART 1. GEOHYDROLOGIC CONDITIONS OF LAVA AQUIFER (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W70-09732

TURBULENT DIFFUSION OF THE VERTICALLY UPWARD JET,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09739

ESTUARINE CONSERVATION LEGISLATION IN THE UNITED STATES,
For primary bibliographic entry see Field 06G.
W70-09786

SIGNIFICANCE OF DDT RESIDUES FROM THE ESTUARY NEAR PENSACOLA, FLA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla., Center for Estuarine and Menhaden Research, Breeze, Fla.
For primary bibliographic entry see Field 05B.
W70-09847

CALCULATION OF COASTAL ENERGY AND DRIFT RATE,
Florida State Univ., Tallahassee. Dept. of Geology.
William F. Tanner.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 2-Seminar Communications), Paper S34, p 313-317, 1967. 5 p, 3 ref.

Descriptors: *Beaches, *Waves (Water), *Beach erosion, *Littoral drift, Ocean currents, Mathematical studies, Sediment transport, Shore protection.
Identifiers: *Spits.

An exponential equation is developed, relating shelf slope to wave energy. Wave energy is taken as the dependent variable. The coefficient on the exponent, and the initial conditions, are obtained from published data. The fit, for certain coasts in the southeastern United States (where convergence-divergence problems are not serious) is good. Depletion-accumulation rates are converted, on the basis of a study of a spit of apparently known dimensions and age, into work figures; this study is then compared with field data from two other, similar, spits. The distance term necessary to make the conversion appears to be about 5 kilometers, for an inferred history of 4,000 years. An impulse determination yields about the same results. For the areas studied, available wave energy is about 1 million times the energy spent in unidirectional littoral sediment transport. (Knapp-USGS)
W70-09853

APPLICATION OF NUMERICAL CALCULATIONS TO THE STUDY OF WAVES AND SHORE INTERACTIONS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
Jean-Pierre Lepetit.
Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 2-Seminar Communications), Paper S32, p 300-306, 1967. 7 p, 6 fig, 3 ref.

Descriptors: *Beaches, *Waves (Water), *Data processing, *Computer programs, Erosion, Engineering, Beach erosion, Statistics, Data collections, Shore protection.
Identifiers: France, Wave energy.

An accurate knowledge of local wave conditions is prerequisite to successful coastal engineering design. This article is a brief description of the various computer calculations employed by the Laboratoire National d'Hydraulique, France, to process wave recorder data. The first of these programs provides a statistical analysis of the raw data. The second program analyzes the variation of the characteristic values as functions of time and predicts the characteristics of the centenary and millenary waves. The third calculation permits a study of inshore conditions by means of wave refraction diagrams. (Knapp-USGS)
W70-09854

AN ANALYSIS OF SALINITY DISTRIBUTION IN THE STRAITS OF MARACAIBO,
Massachusetts Inst. of Tech., Cambridge, Hydrodynamics Lab.; National Inst. of Canalizations, Caracas (Venezuela); and State Univ. of New York, Buffalo. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09857

HYDRAULIC MODEL EXPERIMENT ON THE DIFFUSION DUE TO THE TIDAL CURRENT,
Kyoto Univ. (Japan). Disasters Prevention Research Inst.
Haruo Higuchi.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D9, p 79-88, 1967. 10 p, 14 fig, 3 ref.

Descriptors: *Estuaries, *Diffusion, *Tidal effects, *Currents (Water), Mixing, Model studies, Dye releases, Tracers, Hydraulic models, Hydraulic similitude, Dispersion, Path of pollutants, Waste water disposal.
Identifiers: Japan.

The diffusion phenomena due to tidal currents in the shallow broad estuaries were studied in a hydraulic model experiment for which Ariake Bay in the Amuta area of Kyushu was used as the prototype. Only the tidal current is taken into account. A model of the northern half of Ariake Bay, of which the length is about 90 km, with a horizontal and vertical scale of 1/2000 and 1/200 respectively, was constructed, and a semidiurnal tide was generated by an automatically controlled pneumatic tide generator. The water levels at 5 stations, the current ellipses at 4 stations, and the flow pattern were measured and compared with those in the prototype. Diffusion from an instantaneous point source and from a continuous point source was investigated mainly by a photographic method. Experiments show that tides and tidal currents are accurately reproduced in the model. The diffusion coefficient evaluated through mixing of the water from Chikugo River with sea water is almost the same as in the prototype. However, the diffusion coefficient evaluated through the rate of increase of the dye patch is about 1/3 of that in the prototype. This may be due to the difference between the flow in the model and that in the prototype. (Knapp-USGS)
W70-09859

DIFFUSIVE PROPERTIES OF INTERFACIAL LAYERS,
Chalmers Univ. of Technology, Goteborg (Sweden). Hydraulics Div.
For primary bibliographic entry see Field 05B.
W70-09867

QUANTITATIVE MEASUREMENT OF MARITIME SEDIMENT MOVEMENT USING RADIOACTIVE TRACERS (RUSSIAN),
Polish Academy of Sciences, Gdansk. Inst. of Hydraulic Research.
E. Makowski, and G. Grissener.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/12, p 181-190, 1967. 10 p, 3 fig, 1 tab, 4 ref.

Descriptors: *Sediment transport, *Bottom sediments, *Beaches, *Tracers, *Tracking techniques, Radioisotopes, Radioactivity techniques, Bed load, Littoral drift, Erosion, Sedimentology, Marine geology.
Identifiers: Marine sediments.

The quantitative method of marine sediment tracing involves burying appropriate detectors under the sea bottom. Detectors arranged in this way are covered by a layer of radioactive sediment whose activity is proportional to its mass. Before the labelled sediments are eroded, their initial activity is measured, and then, as the covering is eroded,

easurements are made of the gradual decrease in tivity corresponding to loss of the surface layer of e bottom deposit area under investigation. The acers used in the investigations discussed were tural ones such as Si-31 and artificial ones such activated fragments of sodium glass with Na-24. he proportional dependence of activity on mass s been confirmed for both tracers. This proporonality is very well maintained if a sample of ghly active sediment is introduced into a large ass of inactive sediments. The advantages of this ethod as a possible use of radioisotopes with a ort half-life and a low total activity of the order of few millcuries are discussed. (See also W70-9868) (Knapp-USGS)
70-09877

FFECT OF EUTROPHY AND DESALINATION N THE PHYTOPLANKTONIC POPULATIONS, N FRENCH),
entre d'Oceanographie, Marseille (France). Staon Marine d'Endoume; and Centre Universitaire e Luminy, Marseille (France). Laboratoire d'ydrobiologie Marine.
Blanc, and M. Leveau.
nglish abstract. Marine Biology, Vol 5, No 4, p 83-293, 1970. 14 fig, 6 tab, 16 ref.

escriptors: *Saline water-fresh water interfaces, Phytoplankton, *Desalination, River flow, itrates, Salinity, Sea water, Nutrients, Carbon, itrogen, Hydrogen, Phosphates, Diatoms.
lentifiers: Carbon:Nitrogen ratio, Chlorophyll a, eridiniiae, Rhone River, Mediterranean Sea, Gulf f Fos.

he inflow of the River Rhone into the Gulf of Fos f southern France drastically lowers the salinity of ater, augments its concentration of nutrients, and ncreases as much as 15 times the density of hytoplanktonic organisms in comparison with that f the Mediterranean Sea. The maximum number f cells in water of the gulf is 7.5 million/liter. The igh cellular concentration depresses the rate of he relative photosynthesis, if appraised on the asis of chlorophyll a per million cells. Both plant emains and carbonates of fresh water increase the arbon/nitrogen ratio. (Wilde-Wisconsin)
V70-09897

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

NEW SYNTHETIC MEMBRANES FOR REVERSE OSMOSIS DESALINATION,
Arthur D. Little Research Inst., Inveresk (Scotand).
G. Maconochie, and G. Thomson.
Available for sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $0.65. US Office Saline Water Research and Development Progress Report No 533, June 1970. 64 p, 5 fig, 3 tab, 14 ref. OSW Contract No 14-01-0001-1716.

Descriptors: *Membranes, *Reverse osmosis, Permselective membranes, Semipermeable membranes, Laboratory tests, Thin films, Plastics, Research and development, Membrane processes, Permeability.
Identifiers: Synthetic membranes.

The fabrication and reverse osmosis testing of films made from a number of copolymers derived from galactose methacrylate, glyceryl methacrylate, vinyl carbazole and methyl methacrylate are reported and discussed. Synthesis of these materials is described explicitly. By addition of a 'swelling agent' to the solvent mixture, and immersion before completion of drying, 'Loeb type' heterogeneous films were cast. The effects of after-treatment of films were also investigated, consisting of heating at various temperatures in water, and of immersion in aqueous ethanol. A limiting factor in flow performance is the minimum film thickness attainable and thin homogeneous films were prepared by two alternative methods. Lack of toughness in thin sections seemed a possible reason for the difficulty in obtaining very thin films. A quantity of higher molecular weight galactose methacrylate copolymer was prepared. (Knapp-USGS)
W70-09528

BIBLIOGRAPHY OF DESALTING LITERATURE - 1969.
Columbia Software, Inc., Fairfax, Va.

For sale by Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price $3.25. US Office of Saline Water Research and Development Progress Report No 552, July 1970. 465 p, 4,925 ref, 2 index. OSW Contract No 14-01-0001-2152.

Descriptors: *Bibliographies, *Desalination, *Information retrieval, *Publications, Saline water, Documentation, Salt extraction, Water chemistry, Absorption, Membrane processes, Separation techniques, Nucleation.
Identifiers: *Desalting literature, *Categorized bibliography.

This comprehensive bibliography is in three sections. Section 1 is categorized with 4,925 citations arranged under the following major subjects: Desalting processes, Chemical recovery processes, Dynamic phenomena, Development status, Membranes, Chemical properties, Water, and Energy sources. Each citation includes a reference number which is assigned serially. Section 2 is an author index with names and authors arranged alphabetically, followed by titles and reference numbers of pertinent citations. Reference numbers can be used to locate the reference in Section 1, where source and date published are shown. Section 3 is a descriptor index arranged alphabetically and with titles of citations and reference numbers given under each descriptor. (Lang-USGS)
W70-09529

3B. Water Yield Improvement

DELINEATION OF LINEAR FEATURES AND APPLICATION TO RESERVOIR ENGINEERING USING APOLLO 9 MULTISPECTRAL PHOTOGRAPHY,
Geological Survey, University, Ala.
For primary bibliographic entry see Field 07B.
W70-09537

AGRICULTURAL IRRIGATION AND SALINE QUALITY OF WATER.

Land and Water Law Review, Vol. 5, p 491-499 (1970). 9 p, 38 ref.

Descriptors: *Irrigation water, *Salinity, *Impaired water quality, *Leaching, Water utilization, Saline water, Irrigation, Water supply, Water demand, Water pollution, Irrigation effects, Water quality control, Legislation, Programs, Administrative agencies, Standards, Salt balance, Soil water, Water pollution sources, Irrigation practices, Pollution abatement, Adoption of practices, Legal aspects, Costs.

Salinity--the concentration of dissolved salts in water--is a major water pollution problem in the West. The main cause of this salinity is leaching of minerals from irrigated land. Much legislation has been enacted to abate pollution, many of which promulgate minimum standards of water quality. These standards, however, often do not provide for control of the major source of salinity--agricultural irrigation. Some states do have legislation which could be interpreted to cover irrigation practices. However, the importance of irrigation to many western states' economy militates against any strong action against present irrigation practices by these states. Improved methods of irrigation, such as use of a machine which would allow only enough water to reach plant roots, with no excess to leach the soil, are beyond the economic resources of most irrigators. While little action is now likely against irrigators who presently cannot afford new irrigation techniques, the increasing magnitude of the problem will eventually force changes in these practices. (Caldwell-Florida)
W70-09787

WATER-SUPPLY STRINGENCIES-FEATURES, ANTECEDENTS AND OBSTACLES TO RESOLUTION,
Geological Survey, Carmel, Calif.
For primary bibliographic entry see Field 06B.
W70-09852

WEATHER MODIFICATION POTENTIAL FOR WATER SUPPLY IN THE COLORADO RIVER,
Bureau of Reclamation, Denver, Colo.
Archie M. Kahan.
Paper, Second National Conference on Weather Modification, American Meteorological Society, Santa Barbara, Calif, Apr 1970. 43 p, 9 fig, 2 tab, 19 ref, append.

Descriptors: *Weather modification, Storms, Runoff, Nucleation, Silver iodide, Water resources, Runoff forecasting, *Cloud seeding, *Artificial precipitation, Planning, *Water supply, Atmospheric precipitation, Field investigations, Watersheds (Basins), Public opinion, Public relations, Education, Snowfall, Bibliographies.
Identifiers: Upper Colorado River Basin, Colorado River Pilot Project, San Juan Mountains, Colo.

Weather modification experiments suggest that present-day technology, using silver iodide as the nucleating material, can produce increases of over 200% in snowfall under ideal conditions. An average increase of about 30% seems to be a reasonable long-term expectation. It is estimated that by seeding storms during the winter months only, the 14,200-sq-mi water-producing area of the Upper Colorado River Basin could produce 1,870,000 acre-ft of additional streamflow annually. People problems have been encountered during initial pilot projects. However, as people become aware of the potential value of precipitation augmentation programs, the people problems may well diminish. Precipitation management can be helpful in meeting the growing water needs of the nation. (USBR)
W70-09920

ARIZONA WEATHER MODIFICATION RESEARCH PROGRAM,
Meteorology Research, Inc., Altadena, Calif.
Paul B. MacCready, Jr.
Proceedings of the American Society of Civil Engineers, Journal of Irrigation Drainage Division, Vol 96, No IR2, p 103-110, June 1970. 8 p, 3 fig, 7 ref, append.

Descriptors: *Weather modification, *Cloud seeding, Silver iodide, Atmospheric precipitation, Glaciation, Supercooling, Cumulus clouds, Cloud physics, Radar, Ice, Instrumentation, Aircraft, Nucleation, Field tests, Water resources, Research and development, *Rainfall, Runoff, Meteorology.
Identifiers: *Cloud modification, Skywater Project, Flagstaff (Ariz), Supercooled clouds, Pyrotechnic seeding, Convective clouds.

An interim progress review for the period ending with the fourth summer season at Flagstaff, Ariz, is presented. In 1967, randomized seeding of isolated cumulus clouds was the main experiment. A simple computer model served successfully for test cloud selection and evaluation of results. The experiment demonstrated statistically significant cloud-top height increases (averaging 6000 ft) and approximate doubling of precipitation. Cloud interiors

were probed with an instrumented aircraft. In contrast to events in unseeded clouds, observations of seeded cumuli showed rapid spread of glaciation throughout the clouds. Subsequently, additional buoyancy and organization of the upcurrent, and early shutting off of precipitation growth were noticed. The study in 1967 involved exploratory trials of seeding larger storm systems to organize and stimulate them. In 1968, a program called COOP II brought together the capabilities of several groups to continue the studies, with special emphasis on storm systems and optimizing seeding techniques. (USBR)
W70-09927

ANNUAL AND PERENNIAL BARRIERS IN RELATION TO WIND EROSION AND MOISTURE CONSERVATION,
Agricultural Research Service, Sidney, Mont.
F. H. Siddoway.
Presented at Conservation Tillage Workshop conducted by the Great Plains Agricultural Council, Lincoln, Nebraska, February 27-29, 1968. 21 p, 6 fig, 1 tab, 19 ref.

Descriptors: *Barriers, *Windbreaks, *Great Plains, *Wind erosion, *Water conservation, Precipitation (Atmospheric), Fallowing, Evaporation, Snow, Agriculture, Crop production, Microclimatology.
Identifiers: *Plant-microclimate relationships.

Barriers, whether mechanical or vegetative, invariably alter the microclimate in their vicinity. This results from a combination of factors coinciding with the universal effect of reducing windspeed to the leeward and windward of the barrier. In the Great Plains the primary purposes of the barriers are: (1) Wind erosion control (2) Evaporation reduction (3) Managing snow deposition (4) Crop protection against adverse physical effects of winds. The literature indicates that practically all microclimatological barrier influences in the Great Plains are favorable to plant growth. An equation has been developed, on the basis of the reduced wind speed effect which facilitates the design of predictable barrier erosion control systems. Much evidence indicates maximal water conservation from snow precipitation in the first spring after a crop harvest. This may eliminate the necessity of summer fallowing and consequently reduce wind erosion problems. The resulting annual cropping would offset the disadvantages of land occupancy by the barriers. The major need would be for adequate barrier-spacing design. (Casey-Arizona)
W70-09957

BARRIERS FOR MOISTURE CONSERVATION AND WIND EROSION CONTROL IN THE GREAT PLAINS,
Agricultural Research Service, Sidney, Mont.
F. H. Siddoway.
Presented at the 24th Annual Meeting Soil Conservation Society of America, Colorado State University, Fort Collins, Colorado, August 10-13, 1969. 21 p, 2 fig, 2 tab, 20 ref.

Descriptors: *Barriers, *Windbreaks, *Water conservation, *Great Plains, Semiarid climates, Agriculture, Snowfall.
Identifiers: *Vegetative barriers, *Barrier engineering.

Modifications of windspeed and flow patterns are the primary microclimatic effects of barriers. Reduction of windspeed varies with height multiples of the barrier, distance from the barrier, physical properties of the barrier and wind and ground surface properties. Historically, field barriers in the Great Plains were multiple rows of trees or shrubs. However, these dense barrier belts occupied large amounts of arable land and piled up deep snowdrifts creating water erosion and delaying spring planting. More recently short, single-row, narrowly spaced, barriers have been utilized with better results, particularly in creating more uniform field snow drift distribution under variable wind drift directions. The drier parts of the Great Plains have the most to gain from barrier plantings, but have not yet intensively used them. This is probably because of the rarity of suitable tree species, the expense, difficulty, and long time required for their establishment and their subsequent competition with crop plants. It is suggested that non-tree plant materials be used-shrubs, sorghum, grass, corn. (Casey-Arizona)
W70-09958

PRECIPITATION MODIFICATION IN SEMIARID AND ARID REGIONS,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Charles F. Cooper, and William C. Jolly.
In Ecological Effects of Weather Modification: A Problem Analysis, Chapter 3, p 22-33, School of Natural Resources, University of Michigan, May 1969. 26 ref. Bureau of Reclamation, Office of Atmospheric Water Resources, Contract Number 14-06-D-6576.

Descriptors: *Weather modifications, *Ecology, *Habitats, *Semiarid climates, *Precipitation (Atmospheric), Ecosystems, Arid lands, Streambeds, Stream erosion, Vegetation, Wildlife, Animal behavior, Grasslands, Grazing, Ecotypes, Potholes, Cloudseeding, Streamflow, Sedimentation.
Identifiers: *Vegetation mosaics, *Plant succession.

Weather modifications in semiarid and arid areas will be aimed toward increasing precipitation in agricultural and municipal areas and increasing mountain snowfall to augmentdownstream runoff. The effects of these precipitation changes on various ecosystems involved are examined. The species diversities of natural grasslands are remarkably stable as shown by responses to the drought of the 1930's and to artificial precipitation experiments. The dominant species composition varies over time and space with rainfall according to natural vegetational mosaic self-regulating mechanisms, which may also be influenced by grazing intensity and selectivity. Mammalian populations will respond to weather modifications as complex functions of vegetational changes. A crucial point is that weather modification involving cloud seeding is unlikely to alleviate severe droughts since they are associated with air patterns which inhibit cloud formation. The 10-14 inch average annual rainfall range is critical to stream beds since variations on either side of it will effect changes in runoff flow and sediment yield altering stream channel characteristics. (Casey-Arizona)
W70-09959

INFERENCES FROM ECOLOGICAL THEORY,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Charles F. Cooper, and William C. Jolly.
In Ecological Effects of Weather Modification: A Problem Analysis, Chapter 10, p 109-122, School of Natural Resources, University of Michigan, May 1969. 24 ref. Bureau of Reclamation, Office of Atmospheric Water Resources, Contract Number 14-06-D-6576.

Descriptors: *Ecosystems, *Weather modification, *Habitats, *Precipitation (Atmospheric), *Ecology, Humid areas, Semiarid climates, Arid lands, Soil-water-plant relationships, Competition, Plant populations, Climatology.
Identifiers: *Plant communities, *Marginal habitats, *Climatic variability effects, Genetic resources, Extinctions.

An attempt is made to assess the ecological impacts of weather modification purely on the basis of existing fragmentary ecological theory. Plant species are composed of continuous populations normally distributed between environmental extremes and associated with other plants in communities. A change in rainfall may change a community by expediting the invasion of a new species with differing moisture requirements by eliminating an older species, or by changing abundances of species already present. The argument that weather modification will have no biological effects because it will be entirely within present climatic variability ranges is considered fallacious, because the community, and especially its marginal elements will be affected by changes in mean rainfall over time. Different communities differ in their sensitivity to climatic changes. A fixed proportional change in precipitation will affect humid area plants the least, arid area plants more and semiarid plants the most. Stable climax communities and highly disturbed situations will be least affected. It is theorized that those plant groups least affected will be living in microclimates less variable than regional macroclimates. Animal extinctions are considered unlikely but valuable plant genetic resources may be lost as a result of increasing agricultural homogeneity. (See also W70-00140) (Casey-Arizona)
W70-09960

PHYSIOLOGIC COSTS OF SURVIVAL IN THE DESERT,
Aeromedical Research Lab., Holloman AFB, N. Mex.
W. C. Kaufman.
In: Physiological Systems in Semiarid Environments, Hoff, C. C. and Riedesel, M. L. (editors), p 177-185, University of New Mexico Press, 1969. 4 fig, 1 tab, 7 ref.

Descriptors: *New Mexico, *Solar stills, *Arid lands, *Water conservation.
Identifiers: *Chihuahuan Desert, *Physiologic costs, *Survival techniques.

The solar still requires expenditures of energy and body water in digging for proper placement. The physiologic costs of operation were compared to the return from the still in simulated desert survival conditions in New Mexico. Heat production and energy losses were measured in 5 human subjects using survival tools at 30 degree centigrade daytime temperatures and 25 degree centigrade nighttime temperatures. Additionally, solar still production was measured and compared with soil moisture content. With soil moisture content about 30 percent, results showed a return of only 0.1 liter in the first 24 hours whether digging was done a day or night. It was concluded that standard desert precautions involving avoidance of heat stress are better survival techniques than solar still operation. (Casey-Arizona)
W70-09965

3C. Use of Water of Impaired Quality

BENEFICIAL USE OF WASTE HEAT IN AGRICULTURE,
Oregon State Univ., Corvallis. Dept. of Soils.
Larry L. Boersma.
Fifth Annual Water Resources Research Conference, Feb 3-4, 1970, Washington, D.C., U. S. Dept. of Interior, Office of Water Resources Research, June 1970, p 65-73. 7 fig, 2 tab.

Descriptors: *Cooling water, *Nuclear power plants, *Beneficial use, *Thermal Pollution, *Agriculture, Soil temperature, Crop production, Crop response, Plants growth, Farms, Root development.
Identifiers: *Subsurface heat application.

Heat may stimulate as well as harm growth and development of plants. In geographical regions where soil temperature can limit growth, artificial soil warming becomes attractive. Nuclear reactor cooling water may be expected to have a temperature range of 90 to 100 degrees. A sub-surface application of the heat by circulating the warm water through a network of buried pipes was considered feasible. A field project was conducted. It emphasized evaluation of crop response to increased soil temperatures and a study of rate of heat loss growth rates and yields of tomatoes

strawberries, corn, alfalfa, bush beans, and lima beans growing on heated plots are measured and compared with identical plantings growing on unheated ground. The project has shown promise of success. The problems remained to be studied are: (1) a very dry core around the heat source which was particularly difficult to rewet, (2) thermal conductivity differed from soil to soil, (no system will apply universely), (3) the effect of heat application over a long period on soil. (Hsieh-Vanderbilt)
W70-09597

SALT TOLERANCE OF CROPS AT GERMINATION STAGE,
Udaipur Univ., (India). Agricultural Experiment Station.
G. L. Maliwal, and K. V. Paliwal.
Annals of Arid Zone, Vol 8, No 1, p 109-125, March 1969. 82 ref.

Descriptors: *Soil-water-plant relationships, *Saline soils, *Saline water, *Salt tolerance, *Germination, Irrigation practices, Irrigation water, Toxicity, Root zone, Arid lands, Semiarid climates, Anions, Cations, Sodium, Calcium, Magnesium, Potassium, Chlorides, Sulfates, Osmotic pressure, Alkalinity, Temperature, Soil moisture, Seed treatment, Cereal crops, Legumes, Rice, Cotton, Sugar beets.
Identifiers: *India, *Sodic soils, *Varietal differences, *Ion antagonism, Bajra, Maize, Jowar, Mung, Paddy.

In studying yields of crop plants under saline conditions, particular attention must be paid to germination since it is the crucial limiting factor. A saline substrate may affect germination in 2 possible ways: (1) Soil osmotic pressure build-up resulting in seed water imbalances (2) toxic effects of certain salts. In an effort to separate these effects the literature is reviewed with respect to relative salt tolerances of various crops, particularly legumes and cereal grains, and relative toxicities of differing salts and salt concentrations to differing plants and plant varieties. It appears that crop salt tolerances may vary from crop to crop, among varieties and from germination through different growth stages. Detrimental salinity effects increase at lower soil moisture levels and at higher soil temperatures. Presoaking of seeds in fresh water and leaching or preirrigation of saline soils are 2 methods whereby salinity effects on germination may be lessened. (Casey-Arizona)
W70-09954

3E. Conservation in Industry

INDUSTRIAL USE AND COMMUNITY SUPPLIES OF WATER IN ALABAMA,
Auburn Univ., Ala. Water Resources Research Inst.
For primary bibliographic entry see Field 06D.
W70-09521

SURVEY OF WATER UTILIZATION AND WASTE CONTROL PRACTICES IN THE SOUTHERN PULP AND PAPER INDUSTRY,
North Carolina Water Resources Research Inst., Raleigh.
For primary bibliographic entry see Field 05D.
W70-09668

THE TRANSFER OF WATER RIGHTS FOR USE IN THE OIL INDUSTRY,
For primary bibliographic entry see Field 06E.
W70-09779

3F. Conservation in Agriculture

A COMPLETION REPORT ON SYSTEM SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME-V - STOCHASTIC DEMAND PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09518

WATER BUDGET ACCOUNTING ON TWO CORN-CROPPED WATERSHEDS,
Agricultural Research Service, Brookings, S. Dak.
For primary bibliographic entry see Field 02D.
W70-09532

BASIN PEAT CULTURE FOR WATER ECONOMY,
Helsinki Univ. (Finland). Dept. of Agricultural Chemistry.
For primary bibliographic entry see Field 02G.
W70-09574

EVAPORATION FROM BARE SOIL AND THE WAYS OF REDUCING IT,
Agrophysical Inst., Leningrad (USSR).
For primary bibliographic entry see Field 02G.
W70-09575

WATER MOVEMENT AND USE OF PEAT SOILS IN LOWLAND SWAMPS OF THE U.S.S.R.,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09583

USE OF SOIL MOISTURE AND GROUNDWATER BY COTTON PLANTS UNDER SPRINKLING IRRIGATION IN ARID ZONES,
All-Union Scientific Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09584

WATER MOVEMENT AND ITS UTILIZATION BY PLANTS UNDER THE DEEP WATER STORAGE IN SOIL BY USING OFF-SEASON IRRIGATION,
All-Union Scientific and Research Inst. of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09585

THE REGULARITIES OF GROUNDWATER EVAPORATION IN IRRIGATION LANDS OF THE ARID ZONE,
All-Union Scientific Research Inst. of Hydrogeology and Engineering Geology, Moscow (USSR).
For primary bibliographic entry see Field 02D.
W70-09721

SURVEY OF SEWAGE UTILIZATION FOR AGRICULTURAL PURPOSES IN ISRAEL,
Israel Water Commission.
For primary bibliographic entry see Field 05D.
W70-09760

MATHEMATICAL MODELS IN SOIL PRODUCTIVITY STUDIES, EXEMPLIFIED BY THE RESPONSE TO NITROGEN,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09820

INFLUENCE OF TRANSPIRATION SUPPRESSANTS, SPRINKLER IRRIGATION AND MOISTURE LEVELS ON TRANSPIRATION AND EVAPOTRANSPIRATION,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 02D.
W70-09830

HYDROLOGIC DATA FOR EXPERIMENTAL AGRICULTURAL WATERSHEDS IN THE UNITED STATES, 1963,
Agricultural Research Service, Washington, D.C. Soil and Water Research Div.
For primary bibliographic entry see Field 02E.
W70-09851

INFILTRATION EQUATIONS FROM RATE-OF-ADVANCE DATA,
Saskatchewan Univ., Saskatoon.
For primary bibliographic entry see Field 02G.
W70-09930

DAYTIME STOMATAL CLOSURE IN AGAVE AMERICANA AS RELATED TO ENHANCED WATER-USE EFFICIENCY,
Agricultural Research Service, Phoenix, Ariz. Water Consevation Lab.
For primary bibliographic entry see Field 02D.
W70-09964

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME I - INTRODUCTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09511

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-A - SIM-I - PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09512

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-B - SIM-II PROGRAM DESCRIPTION.
Texas Water Development Board, Austin, Texas.
For primary bibliographic entry see Field 06A.
W70-09513

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-C - ALLOCATION PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09514

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-D - STAGE DEVELOPMENT PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09515

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME III - DATA MANAGEMENT.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09516

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME IV - USERS MANUAL.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09517

URBAN STORM DRAINAGE CRITERIA MANUAL FROM DENVER,
Wright-McLaughlin Engineers, Denver, Colo.
For primary bibliographic entry see Field 08A.
W70-09534

FLOOD PLAIN INFORMATION, BRAZOS AND BOSQUE RIVERS, WACO, TEXAS.
Corps of Engineers, Fort Worth, Tex.

U S Army Corps of Engineers Flood Plain Report, May 1970. 39 p, 8 fig, 24 plate, 10 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: Brazos River (Tex), Waco (Tex), Bosque River (Tex), Standard project flood, Intermediate regional flood.

Flooding of the Brazos and Bosque Rivers, Waco, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09536

IMPROVED METHODS FOR PLANNING OF THERMAL DISCHARGES BEFORE SITE AQUISTION WITH A SPECIFIC CASE EXAMPLE ON THE COLUMBIA RIVER,
Battelle Memorial Inst., Richland, Wash.
R. T. Jaske, W. L. Templeton, J. R. Eliason, and J. C. Sonnichsen.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/46. 32 p, 14 fig, 4 tab, 8 ref. Preprint.

Descriptors: *Computer models, *Thermal pollution, *Columbia River, Power plants, Mixing, Computer programs, Estuarine environment, Water temperatures, Nuclear powerplants, Feasibility studies, Velocity, Flow, Cross-sections, Dispersion, Effluents, Meteorological data, Advection, Grand Coulee Dam.
Identifiers: *COLHEAT, Isopleths.

The highly flexible computation system COL HEAT has been developed and extended for use in estimating interrelated physical effects in estuaries and rivers with highly transient flow conditions. This computer simulation model permits detailed planning of discharges in advance for single and multiple plant locations of overlapping complexity limited only by the accuracy of the input data base. Computer generated illustrations of concentration isopleths are included in the presentation; currently threshold limits of detectability of dye using this method are less than 0.05 ppb, for below visible limits. A special model which relates the hydraulic effects at the point of discharge to thermal tolerances in fish has been developed. The application of this method to a practical case problem was accomplished in work supporting a licence application for a direct cooled reactor plant at Columbia River Mile 78. The predictive needs of this site are very complex because of flow reversals. Based on extensive field data for determining modeling coefficients applicable to the river reach, and prediction of appropriate concentration gradients for the mixed effluent, siting feasibility was recommended. (Osborne-Vanderbilt)
W70-09613

UNDERFLOW PLAN FOR POLLUTION AND FLOOD CONTROL IN THE CHICAGO METROPOLITAN AREA.
Metropolitan Sanitary District of Greater Chicago, Ill. Dept of Public Works and Buildings.
For primary bibliographic entry see Field 05D.
W70-09619

THE CHAMIZAL,
International Boundary and Water Commission, El Paso, Tex.
Joseph F. Friedkin.
In: Water Spectrum, Issues, Choices, Actions, Vol. 2, No. 2, p 25-32, (Summer) 1970. 14 photo.

Descriptors: *Rio Grande, *Boundary disputes, *Canal construction, *Governments, *Coordination, *Water management (Applied), Cost sharing, Engineering, Flood control, Avulsion, Area redevelopment, Texas, Mexico.
Identifiers: *International Boundary and Water Commission, *International Cooperation, El Paso (Texas), Juarez, Chihuahua.

On December 13, 1968, a river that had kept the U.S. and Mexico involved in diplomatic dispute for over 100 years, was rechanneled into a concrete-lined girdle that established a new border at the point where El Paso, Texas, meets Juarez, Chihuahua. The International Boundary and Water Commission, United States and Mexico, a group of international water resource managers and engineers, were responsible. The solution to the problem of the shifting Rio Grande involved two major steps: (1) diplomatic agreement on a permanent boundary, and (2) solutions to the technical and social problems resulting from the new boundary. These problems included encasement of the channnel in concrete; demarcation of the new boundary by topographic survey; construction of five new bridges; compensation and resettlement of dispossessed property owners; and the relocation and construction of new border facilities, railroad lines and interchange yards, and the Bureau of Reclamation's irrigation canal. A program of border improvement including cultural and recreational facilities was also initiated. Engineers and planners from both sections of the Commission worked together and the responsibility and costs of construction were shared equally. The Chamizal project is a monument to International cooperation. In addition the International Boundary and Water Commission is providing international flood control works for urban and irrigation developments along the border, optimum feasible storage, and conservation and regulation of the Rio Grande for utilization by the peoples of the two countries. (Marriott-Chicago)
W70-09639

OPERATION FORESIGHT: A VALUABLE PRECEDENT,
Corps of Engineers, North Carolina Div.
Robert M. Tarbox.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 1, Summer 1969, p 19-26. 11 photo.

Descriptors: *Flood control, *Flood protection, *Flood forecasting, Flood proofing, Warning systems, Flood damage, Levees, Dikes, Damages, Communication, Dredging, Channel improvement.
Identifiers: *'Operation Foresight', Emergency preventive measures, U.S. Army Corps of Engineers.

An account of the activities prior to the actual start of the floods in the Spring of 1969, that led to the unprecedented use of funds on measures to prevent damages. During these operations, North Central Division, spent about $11.9 million which contributed to the prevention of about $106 million in flood damages, as well as inestimable amount of heatbreak and anguish. Under special directive from the President, Corps funds, personnel, equipment, supplies and other resources were made available for full-scale preventive measures. Under a program which the Office of Emergency Preparedness named 'Operation Foresight' the Corps was a principle agency representing the Federal Government. Endangered communities welcomed the offered assistance and provided rights of way, labor, and other community resources. Maximum cooperation was also provided by local, State and Federal agencies in the 26 states in the Snowmelt path. The program included estimations of flood volume, inspection of existing flood control structures, checking of known danger areas, establishment of emergency communications, distribution of literature, flood training, construction of emergency dikes and levees, deepening of channels, experimentation with new materials, and coordination of all involved agencies. (Marriott-Chicago)
W70-09644

URBAN RENEWAL ENGAGES A PARTNER,
Waterloo, Iowa.
Lloyd L. Turner.
Water Spectrum, Issues, Choices, Actions, Volum 1, Number 1, Summer 1969, p 3-9. 8 photo.

Descriptors: *Urban renewal, *Flood control, *Area redevelopment, Multiple purpose projects, City planning, Aesthetics, Recreation, Economics, Benefits, Indirect benefits, Land use, Dredging, Channeling, Zoning, Urbanization, Iowa.
Identifiers: Total planning approach, Waterloo (Iowa).

An abstract written by the Mayor of Waterloo, Iowa, describing that city's approach to two major problems--severe yearly flooding and a large area of slum and blight, the result of unplanned growth in the flood plain. In order to solve the problems of urban redevelopment and flood control, the Westfield-Virden Project was conceived which combined these two originally separate programs into one program. A little more than two miles of riverfront and 1,500 acres of land behind it are involved in the program which hopes to be a model commercial-industrial complex offering improved economy, aesthetic satisfaction and recreational opportunities as well as flood protection and control. Included in the project are plans for a levee serving double function as a highway; re-routing of Black Hawk Creek; rechanneling and clearing Cedar river, using the dredge material as landfill; installation of a new movable dam; clearing of blighted areas; and rezoning of land to allow for industrial expansion. Plans have also been made for use of a sanitary landfill as part of the redevelopment program. Benefits from the program are indirect as well as direct. The expansion of industry will open up some 15,000 new jobs and benefit the local economy by about 240 million a year. Waterloo demonstrates the advantages of a total planning approach and may set an example for future planning. (Marriott-Chicago)
W70-09646

SOME HYDROLOGIC AND BIOLOGIC ASPECTS OF THE BIG CYPRESS SWAMP DRAINAGE AREA, SOUTHERN FLORIDA,
Geological Survey, Tallahassee, Fla. Water Resources Div.
H. Klein, W. J. Schneider, B. F. McPherson, and T. J. Buchanan.
U S Geological Survey Open-file report 70003, May 1970. 94 p, 19 fig, 4 tab, 20 ref.

Descriptors: *Water resources, *Land development, *Urbanization, *Swamps, *Florida, Water quality, Aquifers, Estuaries, Ecology, Canals, Drainage, Saline water intrusion.
Identifiers: *Big Cypress Swamp, *Everglades National Park (Florida).

This report shows the importance of the Big Cypress in maintaining an adequate water supply

for (1) the Everglades National Park; (2) the expanding population of southwestern Florida, and (3) the adjacent estuaries which constitute nurseries for fish, some of which are commercially important. Hydrological information defining the boundaries of Big Cypress Swamp and its subregions on which Everglades National Park depends for its water supply will assist in predicting effects of alternative land uses within Big Cypress Swamp on the ecology of the Everglades National Park. (Woodard-USGS)
W70-09704

USE OF THE HYDRO-INTEGRATOR FOR STUDYING THE FIRST STAGE OF FILTRATION FROM IRRIGATION CANALS,
All-Union Scientific Research Institute for Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09725

FORMATION OF INFILTRATION FLOW FROM CANAL UNDER DEEP OCCURRENCE OF GROUNDWATER,
All-Union Scientific and Research Institute of Hydrotechnics and Reclamation, Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-09726

GROUNDWATER POTENTIAL AND SCOPE OF STUDY OF WATER MOVEMENT IN UNSATURATED ZONE IN EAST PAKISTAN,
East Pakistan Water and Power Development Authority, Dacca.
For primary bibliographic entry see Field 02G.
W70-09729

HORIZONTAL SEEPAGE THROUGH UNCONFINED AQUIFERS TAKING INTO ACCOUNT FLOW IN THE CAPILLARY FRINGE,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 02G.
W70-09730

RAPID-FLOW FILTER FOR SEWER OVERFLOWS.
Rand Development Corp., Cleveland, Ohio.
For primary bibliographic entry see Field 05G.
W70-09741

MAGNOLIA APARTMENTS, INC V HANES (CLAIM OF DAMAGE CAUSED BY INCREASED FLOW FROM UPHILL PROPERTY).
For primary bibliographic entry see Field 06E.
W70-09783

SUGGESTIONS FOR A MODEL FLOOD PLAIN ZONING ORDINANCE,
For primary bibliographic entry see Field 06F.
W70-09785

REPORT TO THE CITY OF FLINT, MICHIGAN ON SANITARY AND STORM SEWER SYSTEMS.
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 05G.
W70-09797

THE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09798

POLLUTION AND FLOOD CONTROL, A PROGRAM FOR CHICAGOLAND.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09799

FLOOD PLAIN INFORMATION, PARKER CREEK, MARSHALL, TEXAS.
Corps of Engineers, Fort Worth, Tex.

U S Army Corps of Engineers Flood Plain Report, April 1970. 33 p, 7 fig, 13 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Marshall (Texas).

Flooding of Parker Creek, Marshall, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09845

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, ORANGE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.

U S Army Corps of Engineers Flood Plain Report, April 1970. 32 p, 9 fig, 7 plate, 8 tab.

Descriptors: *Floods, *Flood damage, *Florida, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Historic flood.
Identifiers: Orange County (Fla), Standard project flood, Intermediate regional flood.

Flooding of the Little Wekiva River, Orange County, Florida is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-09846

RAULS V COSTNER (DRAINAGE DISTRICT'S LIABILITY FOR FLOOD WATERS CAUSED BY ERECTION OF NEW LEVEE).
For primary bibliographic entry see Field 06E.
W70-09895

KENTUCKY GAME AND FISH COMM'N v BURNETT (STATE FISH COMMISSION'S LIABILITY FOR FLOOD DAMAGE CAUSED BY ERECTION OF DAM FOR FISH HATCHERY).
For primary bibliographic entry see Field 06E.
W70-09913

BENTONITE SEALING METHODS COMPARED IN THE FIELD,
Bureau of Land Management, Prineville, Oreg; and Agricultural Research Service, Reno, Nev.
Myron B. Rollins, and Anthony S. Dylla.
Proceedings of the American Society of Civil Engineers, Journal of the Irrigation Drainage Division, Vol 96, No IR2, p 193 203, June 1970. 11 p, 8 tab, 8 ref, append.

Descriptors: *Bentonite, Methodology, Field tests, *Reservoirs, *Reservoir leakage, *Sealants, *Soil sealants, Blankets, Seepage, Sands, Protective coatings, Linings, Construction costs, Irrigation canals, Costs, Buried membranes, Clays.
Identifiers: *Small reservoirs, *Small impoundments, *Seepage control.

Twelve small reservoirs were constructed at each of 2 sites in western Nevada to test methods of sealing with bentonite. Utah bentonite was installed as the following types of seals: (1) waterborne-harrowed, (2) waterborne-over-a-gravel surface, (3) surface blanket, (4) buried blanket, and (5) buried membrane. The waterborne-harrowed seals were short lived. The waterborne seals on reservoirs with graveled surfaces were effective only slightly longer, becoming ineffective after the third season. The 4-in. surface blanket seals were more durable, their effectiveness lasting about 5 seasons. The buried blanket and buried membrane seals proved to be the best, retaining 60% effectiveness 6 yr after installation. Costs of bentonite sealing varied from $0.20 to $1.30/sq yd of soil surface, and are comparable with other methods of sealing, such as plastics. (USBR)
W70-09928

KYLE V ST FRANCIS LEVEE DIST (LEVEE DISTRICT'S LIABILITY FOR WATER DAMAGE CAUSED BY INTERFERENCE WITH SURFACE DRAINAGE).
For primary bibliographic entry see Field 06E.
W70-09940

MORTON V BOROUGH OF DORMONT (CITY'S LIABILITY FOR DAMAGE CAUSED BY INCREASE IN NATURAL FLOW OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W70-09991

GULF OIL CORP V THE BALTIMORE (DREDGE COMPANY'S LIABILITY FOR OBSTRUCTION OF NAVIGABLE CHANNEL).
For primary bibliographic entry see Field 06E.
W70-09995

GALLERANI V UNITED STATES (DAMAGE TO WELL FROM CANAL IMPROVEMENT).
For primary bibliographic entry see Field 06E.
W70-09996

BOARD OF TRUSTEES V BOARD OF SUPR'VSRS (COMPULSORY CONTRIBUTION BY DRAINAGE DISTRICTS FOR MAINTENANCE OF COMMON FACILITIES).
For primary bibliographic entry see Field 06E.
W70-10006

MAYOR AND CITY COUNCIL OF HAVRE DE GRACE V MAXA (CITY'S LIABILITY FOR DAMAGES TO RIPARIAN OWNER CAUSED BY NEGLIGENT CONSTRUCTION OF RETAINING WALL).
For primary bibliographic entry see Field 06E.
W70-10010

WILLIS V UNITED STATES (COMPENSATION FOR FLOODING OF RIPARIAN LAND CAUSED BY FEDERAL DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-10012

MUTUAL CHEMICAL CO OF AMERICA V MAYOR AND CITY COUNCIL OF BALTIMORE (RELATIVE BULKHEAD--FILL RIGHTS).
For primary bibliographic entry see Field 06E.
W70-10015

GOODMAN V UNITED STATES (DAMAGE FROM GOVERNMENT'S NAVIGATION PROJECT).
For primary bibliographic entry see Field 06E.
W70-10016

HUMBOLDT LOVELOCK IRR LIGHT AND POWER CO V SMITH (STATE REGULATION OF RIVER WATER DIVERSION).
For primary bibliographic entry see Field 06E.
W70-10017

HAGIE V LINCOLN LAND CO (CHARGE OF POINT OF DIVERSION FROM STREAM CLAIMED TO BE ABANDONMENT OF RIGHT TO DIVERT).
For primary bibliographic entry see Field 06E.
W70-10021

4B. Groundwater Management

WASTE DISPOSAL AND EARTHQUAKES AT THE ROCKY MOUNTAIN ARSENAL, DERBY, COLORADO,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 05E.
W70-09539

UNDERGROUND WASTE DISPOSAL,
Gurnham and Associates, Inc., Chicago, Ill.
For primary bibliographic entry see Field 05E.
W70-09543

SOME CONSIDERATIONS IN UNDERGROUND WASTE WATER DISPOSAL,
Ohio River Valley Water Sanitation Commission, Cincinnati; and Missouri Univ., Columbia. Dept. of Geological Engineering.
For primary bibliographic entry see Field 05E.
W70-09549

GROUNDWATER RESOURCE EVALUATION,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02F.
W70-09551

SUMMARY RECORDS OF SUPPLY WELLS AND TEST WELLS IN THE POST HEADQUARTERS AREA, WHITE SANDS MISSILE RANGE, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 02F.
W70-09684

HYDROGEOLOGICAL MAPS OF KOREA - VOL 1, ANSEONG RIVER BASIN, (KOREAN),
Geological Survey of Korea, Seoul.
For primary bibliographic entry see Field 02F.
W70-09706

ARTIFICIAL RECHARGE OF SUBTERRANEAN AQUIFERS,
Akademiya Nauk SSSR, Moscow. Institut Geologii Rudnykh Mestorozhdenii, Petrografii, Mineralogii i Geokhimii.
G. Bogomolov, and Yu Bogomolov.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 879-884, 1968. 6 p, 1 fig, 31 ref.

Descriptors: *Artificial recharge, *Aquifers, *Hydrogeology, Water wells, Induced infiltration, Water management (Applied), Water resources development, Water Supply.

Based on the analysis of natural conditions, a characteristic of main hydrological parameters determining the suitability of some regions for artificial groundwater recharge at the expense of infiltration of atmospheric precipitation and waters of surface-stream flow is given. Data on optimal distances of infiltration zones from areas of location of water-catchment systems are reported for different types of rocks as well as the estimation of the efficiency of water-catchment systems. (See also W70-09728 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09727

ARTIFICIAL RECHARGE FOR GROUNDWATER STORAGE IN THE UNSATURATED ZONE,
Food and Agricultural Organization of the United Nations, Rome (Italy).
R. P. Ambroggi.
French resume. In: Water in the Unsaturated Zone, Vol II, Proceedings of the Wageningen Symposium, The Netherlands, June 19-25, 1966, International Association of Scientific Hydrology, Publication No 83, p 884-885, 1968. 2 p, 1 ref.

Descriptors: *Artificial recharge, *Aquifers, *Hydrogeology, Water wells, Induced infiltration, Water spreading, Water management (Applied), International Hydrological Decade, Water resources development, Water supply.
Identifiers: Research recommendations.

A brief review is given of the requirements of artificial recharge for groundwater storage. Some examples are given of the application of artificial recharge in the unsaturated zone. It is conducted that the International Hydrological Decade should provide an opportunity to further study of groundwater storage in the unsaturated zone by means of artificial recharge through spreading grounds. (See also W70-09729 and W70-09568 thru W70-09592) (Knapp-USGS)
W70-09728

STUDY ON SALT WATER INTRUSION INTO GROUNDWATER - PART 1. GEOHYDROLOGIC CONDITIONS OF LAVA AQUIFER (JAPANESE),
Industrial Science and Technology Agency, Kawasaki (Japan). Geological Survey.
For primary bibliographic entry see Field 02F.
W70-09732

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES,
Alabama Univ., University, Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09771

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX A: DESIGN AND COST OF LIQUID-WASTE DISPOSAL SYSTEMS,
Alabama Univ., University, Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09772

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX B: PART I CHEMICAL REACTIONS BETWEEN ACID INDUSTRIAL WASTES, FORMATION WATERS, AND MINERALS IN SALAQUIFERS OF ALABAMA; PART II, LABORATORY STUDY OF SELECTED RESERVOIR ROCKS,
Alabama Univ., University. Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09773

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX C: STRATIGRAPHY OF ALABAMA (WITH A SECTION ON PHYSIOGRAPHY),
Alabama Univ., University. Natural Resources Center.
For primary bibliographic entry see Field 05E.
W70-09774

4C. Effects on Water of Man's Non-Water Activities

STORM WATER POLLUTION FROM URBAN LAND ACTIVITY,
AVCO Economic Systems Corp.
For primary bibliographic entry see Field 05B.
W70-09615

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05B.
W70-09637

KNOX COUNTY V MONCIER (INVERSE CONDEMNATION SUIT BROUGHT BECAUSE OF FLOODING CAUSED BY HIGHWAY CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09676

EFFECTS OF DEICING SALTS ON WATER QUALITY AND BIOTA-LITERATURE REVIEW AND RECOMMENDED RESEARCH,
Virginia Polytechnic Inst., Blacksburg.
For primary bibliographic entry see Field 05C.
W70-09705

RUST V CITY OF NEWPORT (CITY'S LIABILITY FOR WATER DAMAGE TO PROPERTY ALONG NEW ROAD CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09931

CHICK SPRINGS WATER CO V STATE HIGHWAY DEPT (STATE'S LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT CULVERT CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-09985

HICKS V ANDERSON (LANDOWNER'S RIGHT TO HAVE PROPERTY CONDEMNED AFTER DAMAGE RESULTS FROM STATE ACTION).
For primary bibliographic entry see Field 06E.
W70-10007

4D. Watershed Protection

TESTS OF THEORETICAL CALCULATIONS OF DISCHARGES OF SUSPENDED SEDIMENT IN PLAINS RIVERS,
For primary bibliographic entry see Field 02J.
W70-09910

STAMFORD DOCK AND REALTY CORP V CITY OF STAMFORD (CITY'S LIABILITY FOR SEDIMENT DISCHARGE FROM STORM DRAINS AND SEWERS).
For primary bibliographic entry see Field 06E.
W70-09988

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

THE APPLICATION OF LASER IONIZATION MASS SPECTROMETRY TO THE IDENTIFICATION OF ORGANIC SALTS IN POLLUTED WATER,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
F. J. Vastola, and R. O. Mumma.
Available from NTIS as PB-193 797, $3.00 in paper copy, $0.65 in microfiche. Institute for Research on Land and Water Resources, Research Project Technical Completion Report, University Park, Pa., Aug 1969. 6 p, 1 tab, 2 fig, 1 append. Contract No 14-01-0001-1858. OWRR Project A-0190PA (1).

Descriptors: *Pollution abatement, *Pollutant identification, *Analytical techniques, *Detergents, *Ionization, Sulfates, Ions, Sulfonates, Organic compounds.
Identifiers: *Laser ionization, *Mass spectrometry, *Detergent residues, Organic salts, Organic sulfonates, Organic compounds.

Laser ionization mass spectrometry was demonstrated to be applicable for the analysis of organic salts typical of those salts found in polluted waters. Various methods of introducing the sample into the mass spectrometer were investigated. Procedures were developed for the analysis of microgram samples and compilation of spectra of sulfonates, thiosulfates, and sulfates was initiated. (See also W70-09523) (Sink-Penn State Univ)
W70-09522

ANALYSIS OF ORGANIC SALTS BY LASER IONIZATION,
Pennsylvania State Univ., University Park. Dept. of Materials Science.
F. J. Vastola, R. O. Mumma, and A. J. Pirone.
Organic Mass Spectrometry, Vol 3, p 101-104, 1970. 1 tab, 1 fig, 2 ref. OWRR Project A-019-PA.

Descriptors: *Pollution abatement, *Pollutant identification, *Analytical techniques, *Detergents, *Ionization, Sulfates, Ions, Sulfonates, Organic compounds.
Identifiers: *Laser ionization, *Mass spectrometry, *Detergent residues, Organic salts, Organic sulfonates, Organic compounds.

Alkali salts of 1-hexyl sulfonate were ionized by laser irradiation and the positive ions were analyzed by time-of-flight mass specrometry. The sodium, potassium, rubidium and cesium salts produce relatively simple spectra. The major organic ions observed are due to the salt plus a cation or the dimer plus a cation. No molecular or fragment ions were detected. The instrumentation and the method of interpreting these data are described. (See also W70-09522)
W70-09523

REPORT ON THE FEDERAL-STATE-INDUSTRY COOPERATIVE SAVANNAH RIVER WATER QUALITY STUDIES, 1956-1965.
Public Health Service, Atlanta, Ga. Savannah River Advisory Board.
For primary bibliographic entry see Field 05G.
W70-09552

POTOMAC RIVER WATER QUALITY NETWORK, COMPILATION OF DATA-WATER YEAR 1969.
Interstate Commission on the Potomac River Basin, Washington, D.C.
Interstate Commission on the Potomac River Basin Data Compilation Report, 1969. 92 p, 2 fig, 3 map.

Descriptors: *Data collections, *Water quality, Biochemical oxygen demand, Suspended load, Turbidity, Data storage and retrieval, Coliforms, Dissolved oxygen, Algae, Nutrients, Solutes, Chlorides, Calcium, Carbonates, Phosphates.
Identifiers: Potomac River basin.

Water quality data from the Potomac River basin are summarized. The water statistics are obtained from samples taken at 80 stream sampling points in the basin. The samples were taken and analyzed by agencies, industries and municipalities. An explanation of parameters is included. The data obtained this water year were stored in the Federal Water Pollution Control Administration computer-Storet. (Knapp-USGS)
W70-09557

CHLORINATED HYDROCARBONS IN MARINE ECOSYSTEMS,
California Univ., Berkeley. Inst. of Marine Resources.
R. W. Risebrough.
In: Chemical Fallout-CURRENT RESEARCH ON PERSISTENT PESTICIDES, Proceedings Publication of Rochester Univ. Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 5-23, 1969. 19 p, 4 tab, 39 ref. NSF Grant GP 6362.

Descriptors: *Pesticide drift, *Pacific Ocean, *Pesticide residues, *Water pollution sources, *Chlorinated hydrocarbon pesticides, DDT, Dieldrin, Water pollution effects, Toxicity, Path of pollutants, Environmental effects, Ecology.
Identifiers: Chlorinated hydrocarbons.

Polychlorinated biphenyls, chlorinated hydrocarbons which are extensively used in industry and agriculture, are now widely distributed in marine ecosystems of the Pacific Ocean. Birds contain higher concentrations of these chemicals than fish; tissues of the peregrine flacon have contained the highest amounts which have so far been recorded. The polychlorinated biphenyls have not been detected in samples of airborne particulates but their observed distribution in the sea indicates that they are dispersed by wind currents and that their fallout pattern is similar to that of the DDT compounds. Their effects upon natural populations, including man, are as yet unknown. Among the chlorinated hydrocarbon 'pesticides', DDE is accumulating in significant amounts in marine food chains, and is also present in highest concentrations in marine birds, especially the procellariiform species. Its distribution indicates that coastal areas are not the primary sources of contamination. Wind transport can account for the observed distribution of DDT compounds in California waters. (See also W70-09559) (Knapp-USGS)
W70-09560

THE SIGNIFICANCE OF DDT RESIDUES IN ESTUARINE FAUNA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
P. A. Butler.
In: Chemical Fallout-Current Research on Persistent Pesticides, Proceedings Publication of Rochester Univ Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 205-220, 1969. 16 p, 3 fig, 3 tab, 8 ref.

Descriptors: *Pesticide residues, *Persistence, *Estuarine environment, *Pesticide toxicity, *Environmental effects, DDT, Pesticide drift, Water pollution effects, Chlorinated hydrocarbon pesticides, Water pollution sources, Path of pollutants, Ecology, Aquatic environment, Estuaries.
Identifiers: Estuarine fauna.

A nationwide program was initiated in 1965 to monitor residues of ten synthetic, chlorinated hydrocarbon pesticides in estuarine populations of fish and shellfish. About 160 stations have been established where samples are collected at thirty-day intervals for analysis by gas chromatography with electron capture. The summarized data show that estuarine pollution levels reflect the intensity of agriculture in the associated river basin. Experiments were undertaken to determine effects of a DDT-contaminated diet on fish and crustaceans. There was essentially no correlation between the amount of DDT residue and the size of the animal or the length of time it fed on the contaminated food. The experimental and monitoring data indicate that existing widespread pesticide pollution is causing significant decreases in productivity of estuarine populations of fish and shellfish. Resistant surviving animals are instrumental in concentrating and transmitting lethal amounts of pesticide residues in the food web. (See also W70-09559) (Knapp-USGS)
W70-09564

COMPARISON OF THE WATER QUALITY OF THE BOIS BRULE AND POPLAR RIVERS, WISCONSIN - BOTH TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
Donald A. Bahnick, Joseph W. Horton, and Ronald K. Roubal.
Available from the NTIS as PB-194 030, $3.00 in paper copy, $0.65 in microfiche. Center for Lake Superior Environmental Studies, Contribution No 16 (1970). 15 p, 4 fig, 4 ref. OWRR A-023-WISC (4).

Descriptors: *Water quality, Wisconsin, Color, Chemical oxygen demand, Rainfall, Nitrogen, Phosphorus, Hydrogen ion concentration, *Pollutant identification, Dissolved oxygen, Copper, Water chemistry, *Water analysis.
Identifiers: Bois Brule River, Poplar River, Specific conductance, Total solids.

A study of certain chemical parameters for the Poplar River, Wisconsin, Watershed is presented. Parameters determined were, nitrogen, phosphorus, copper, dissolved oxygen, chemical oxygen demand, specific conductance, color value, total solids, and pH. The collected data were correlated with rainfall and terrain in the drainage basin of the Popular River. These results were compared with a similar study of the Bois Brule River, a neighboring stream, which was studied in 1968. (See also W70-09675)
W70-09674

MERCURY IN THE MARINE ENVIRONMENT,
Scripps Institution of Oceanography, La Jolla, Calif.
David H. Klein, and Edward D. Goldberg.
Environmental Science and Technology, Vol 4, No 9, p 765-768, September 1970. 4 p, 3 fig, 1 tab, 17 ref.

Descriptors: *Water pollution sources, *Poisons, *Heavy metals, Chemical wastes, Sea water, Path of pollutants, Pollutant identification, California.
Identifiers: Mercury, Methyl mercury.

Mercury levels in marine sediment and three marine organisms--crab, whelk, and rock scallop--are 500 times or more greater than those in seawater of the California coastal environment of La Jolla and Palos Verdes. The subject of mass poisoning in aquatic life of recent note, mercury is released to the environment at an estimated rate of 4000-5000 tons annually. Higher values of mercury are found in sediments near sewer outfalls as compared to similar deposits further removed. The dispersion of this toxic pollutant by marine organisms and by man has already had serious consequences. (Knapp-USGS)
W70-09677

THE CHEMISTRY OF THE INTERSTITIAL WATER AS A MEASURE OF CONDITIONS IN A SANDY BEACH,
National Inst. for Water Research, Congella (South Africa).

W. D. Oliff, B. D. Gardner, W. D. Turner, and J. B. Sharp.
Water Research, Vol 4, No 2, p 179-188, February 1970. 10 p, 1 fig, 6 tab, 6 ref.

Descriptors: *Path of pollutants, *Biodegradation, *Beaches, Sands, Water pollution effects, Surf, Aeration, Dissolved oxygen, Oxygen demand, Sewage, Water pollution sources.
Identifiers: South Africa.

Interstitial waters of beaches were analyzed to determine the ability of the beach and surf zone to assimilate sewage. Water samples were drawn from about three below the surface of the beaches, about mid-way between low and high tide marks in the swash zone during low water of spring tides. The sea water samples were taken from the surf at the same place and time. Analyses were made for dissolved oxygen, salinity, pH, nitrite, ammoniacal and Kjeldahl nitrogen, and total phosphorus content. Two groups of experiments were performed. The first was done on a beach 20 mi. south of Durban, S. Africa, around a factory effluent outfall containing about 250 mg/liter of ammoniacal N. The second group covered three pairs of stations in the Durban area which were sampled at fortnightly intervals for 6 months. The first pair was at Brighton Beach, apparently a normal beach. The second pair was 100 yd from the Umgeni river mouth, under the influence of a moderate load of pollution. The last pair was 100 ft south of the mouth of the Umlaas River Canal which is highly polluted with industrial and domestic waste. The beaches, even those which were somewhat polluted, have all been apparently normal and aesthetically unobjectionable. The sea and the local beaches can accept greater loads of enriching material than encountered in these studies. (Knapp-USGS)
W70-09679

APPLICATIONS OF FLUORESCENCE SPECTROSCOPY TO FUNDAMENTAL PROBLEMS IN INSECT BIOCHEMISTRY,
Georgia Univ., Athens. Dept. of Entomology.
Chester M. Himel, and Richard T. Mayer.
Journal of Georgia Entomology Society, Vol 5, No 1, p 31-38, January 1970. 8 p, 2 fig, 1 tab, 21 ref. FWQA Grant 16020 EAO.

Descriptors: *Insecticides, *Biochemistry, *Enzymes, *Inhibitors, *Tracers, Analytical techniques, Metabolism, Pigments, Spectrophotometry, Spectroscopy, Fluorescence, Organic compounds, Insects, Animal physiology.
Identifiers: Fluorescence spectroscopy, Insect biochemistry.

Intrinsic fluorescence of enzymes which contain tryptophan can be used to study their conformation and dynamics. Fluorescent molecules can also be designed and synthesized that will bind (reversibly or irreversibly) with enzymes and other biopolymers. The fluorescence resulting here is referred to an extrinsic fluorescence. When the spectroscopic response (fluorescence excitation, emission and quantum yield) is a function of the environment of the bound fluorescent moiety, the fluorescent moiety is termed a fluorescent probe. Intrinsic and extrinsic fluorescent probes are discussed. Examples are given of designed, active-site-directed, reversible enzyme inhibitors which act as fluorescent probes. Such applications of fluorescence spectroscopy constitute a new and potentially very important methodology in insect biochemistry that is pertinent to our understanding of the mode of action of insecticides. (See also W70-06754; W70-09683 and W70-09770) (Knapp-USGS)
W70-09682

5-DIMETHYLAMINONAPHTHALENE-1-SULFONIC ACID (DANS ACID) AS STANDARD FOR QUANTUM YIELD OF FLUORESCENCE,
Georgia Univ., Athens. Dept. of Entomology.
For primary bibliographic entry see Field 05C.
W70-09683

ANALYSIS OF MULTICOMPONENT ORGANIC MIXTURES IN AQUEOUS MEDIA BY PYROLYSIS,
Rocketdyne, Canoga Park, Calif. Research Div.
Ihor Lysyj, Kurt H. Nelson, and Steve R. Webb.
Summaries in French and German. Water Research, Vol 4, No 2, p 157-163, February 1970. 7 p, 1 fig, 2 tab, 4 ref.

Descriptors: *Pollutant identification, *Organic compounds, *Oily water, *Water pollution sources, *Chromatography, Analytical techniques, Gas chromatography, Mathematical studies, Waste identification.
Identifiers: Pyrolysis.

For general characterization of industrial and municipal wastes in waterways, a direct pyrographic approach is based on high temperature pyrolysis of the water sample followed by immediate gas chromatographic separation of the resulting organic fragments. The amounts of these separated fragments are then measured with a hydrogen flame ionization detector. Through mathematical treatment utilizing all pyrographic peaks, the recorded pyrogram can be interpreted in terms of concentrations of the original organic components. Application of the technique to solutions containing a total of 100 ppm glycerol, DL-valine, and hexanoic acid in various ratios gave a standard deviation of 1.7 ppm. The sensitivity of the technique is sufficient to detect oil pollution levels of less than 10 ppm. (Knapp-USGS)
W70-09694

WATER QUALITY SURVEY OF THE POTOMAC ESTUARY - 1965-1966,
Federal Water Pollution Control Administration, Annapolis, Md. Chesapeake Technical Support Lab.
Donald W. Lear, Jr., and James W. Marks.
Federal Water pollution Control Administration, Chesapeake Technical Support Lab, Data Report No 9, 1970. 71 p, 1 tab, 1 map.

Descriptors: *Water quality, *Sampling, *Data collections, Rivers, Water temperature, Turbidity, Suspended load, Dissolved oxygen, Biochemical oxygen demand, Organic matter, Nitrogen, Nitrates, Nitrites, Ammonia, Phosphorus, Chlorides, Chlorophyll.
Identifiers: Potomac River Estuary.

Water samples were collected in 1965 and 1966 to determine existing water quality of the Potomac estuary. Surface samples for chemical analysis were obtained by dipping a plastic bucket or large funnel into the river water with a minimum of agitation. Bottom samples were taken using a plastic Van Dorn sampler. Tabulated data include water temperature, turbidity, suspended solids, volatile solids, dissolved oxygen, biochemical oxygen demand, total carbon, total Kjeldahl nitrogen, organic nitrogen, ammonia, nitrate, nitrite, total phosphorus, inorganic phosphorus, chlorides, and chlorophyll a. (Knapp-USGS)
W70-09769

AN NMR STUDY OF THE PROTOLYSIS KINETICS OF SULFONAMIDES,
Georgia Univ., Athens. Dept. of Chemistry; and Georgia Univ., Athens. Dept. of Entomology.
J. F. Whidby, D. E. Leyden, C. M. Himel, and R. T. Mayer.
Georgia University Department of Entomology Research Support, 1970. 9 p, 4 fig. FWPCA Grant 16020-EAO.

Descriptors: *Biochemistry, *Tracers, *Organic compounds, *Nuclear magnetic resonance, *Sulfur compounds, Fluorescence, Ion exchange, Analytical techniques, Enzymes.
Identifiers: *Sulfonamides.

An NMR study was made of the protolysis of 5-dimethyl aminonaphthalene-1-sulfonic acid (DANS-acid) (I) and its N-methyl sulfonamide (II). Proton exchange studies on the 5-dimethyl amino group (5-DMA) of I and II were carried out in aqueous H_2SO_4 whereas proton exchange of the N-methyl sulfonamide moiety in II was carried out in aqueous 16.0 mole percent t-butanol. The pK of the 5-DMA moiety of I was determined to be 3.5 in 16% t-butanol by NMR and to be 4.52 + .03 in H_2O by spectrofluorescence measurements. (See also W70-06754, W70-09682 and W70-09683) (Knapp-USGS)
W70-09770

INTERMEDIATE PRODUCTS IN THE BACTERIAL DECOMPOSITION OF HEXADECANOL AND OCTADECANOL,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 05B.
W70-09829

RADIOISOTOPE TECHNIQUES DEVELOPED IN WATER-POLLUTION STUDIES,
Water Pollution Research Lab., Stevenage (England).
G. E. Eden, and R. Briggs.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/13, p 191-206, 1967. 16 p, 9 fig, 4 tab, 6 ref.

Descriptors: *Path of pollutants, *Tracers, *Tracking techniques, Radioisotopes, Radioactivity techniques, Sewage treatment, Dispersion, Monitoring, Instrumentation, Sediment transport, Bed load, Suspended load.
Identifiers: Water pollution tracers.

During the last 10 yr radioisotopes have been used in many aspects of water-pollution research to provide information which could not have been otherwise obtained. Instrumentation for tracing dispersal of sewage in the sea is discussed. The tracer bromide Br-82 is added continuously to the flow of sewage entering the sea through a submerged outfall, or alternatively as a single dose to the sea at the site of a hypothetical outfall. The dispersal is mapped by scanning the area with gamma scintillation counters towed at predetermined depths, continuously monitored by echo sounders. Double-labelling techniques are described. By use of a non-adsorbable tracer (for example bromide Br-82, or cobalticyanide Co-60 or Co-58) to label the liquid phase and a highly adsorbed tracer (for example Au-198 or Ag-110) to label the solid phase, it is possible to study segregation effects. The technique was used to demonstrate the short-circuiting of solids in a sludge-digestion system and to compare relative retention periods of dissolved and suspended matter in a percolating filter. By simultaneous addition of a non-adsorbed tracer and the radioisotope under investigation it is possible to detect reversible adsorption on the bed of a stream or on the walls of a sewer. Measurements of the ratio of the activities due to the two tracers at a point downstream provides an extremely sensitive method of detecting reversible adsorption; this procedure might well be of use in selecting tracers for the determination of flow in streams by tracer methods. (See also W70-09868) (Knapp-USGS)
W70-09878

QUANTITATIVE ANALYSIS OF TOTAL CARBON DIOXIDE IN SEA WATER: A NEW EXTRACTION METHOD,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 07B.
W70-09892

THE NATURE OF AQUATIC POLLUTION,
State Univ. Coll., Fredonia, N.Y. Lake Erie Environmental Studies.
John A. Jones.
State University College, Fredonia, New York, Lake Erie Environmental Studies, Public Information Report No 2, 1970. 36 p, 23 fig.

Descriptors: *Water pollution sources, *Water pollution, *Water pollution effects, Pollutants, Coliforms, Toxicity, Nutrients, Suspended load, Nuclear wastes, Eutrophication, Sewage, Agriculture, Industrial wastes, Pesticides, Thermal pollution, Tertiary treatment, Detergents, Lake Erie, Bacteria, Viruses, Protozoa, Fungi, Worms, Radioisotopes, Salmonella, Shigella, Clostridium, Red tide, Mollusks, Trematodes, Chemicals, Copepods, Nematodes, Biochemical oxygen demand, DDT, Heavy metals, Nitrogen, Phosphorus, Powerplants, Cyanophyta, Wastes, Dredging.
Identifiers: Floating debris, Synergistic effects, Parasitic diseases, Classification of pollutants, Biological concentration, Petroleum industries, Parasitic worms, Biological pollutants, Chemical pollutants, Physical pollutants, Flow barriers, Shipping wastes, Boating wastes, Sublethal effects.

Water pollutants have been categorized as biological, chemical, and physical. The potential presence of most disease organisms may be detected by tests which determine the numbers of coliform bacteria. Chemical pollutants include substances exerting an oxygen demand, lethal and sublethal toxic substances, unpleasant non-toxic materials, and fertilizing nutrients. Presence and quantity of these pollutants are determined by chemical analyses, and their effects are generally readily evident in the environment. Physical pollutants include suspended sediments, floating debris, nuclear waste materials, and heat energy; these affect basic biological processes of organisms inhabiting natural waters or destroy the values of aquatic resources. Pollutants exert synergistic effects on aquatic organisms; thus, the presence of one pollutant increases the susceptibility of organisms to the other pollutants and environmental stresses. Chemical and physical pollutants appear to be the most problematical to the general environment; these include especially oxygen demand, eutrophication, toxic substances, and waste heat. The most hazardous pollution directly affecting the health of man are biological and chemical, including parasitic diseases and biologically accumulated toxic substances. Recovery and reuse of 'wastes' appears to be the only feasible solution to waste disposal in the long-term view. (Jones-Wisconsin)
W70-09906

TOXICITY EVALUATION OF A TECHNIQUE FOR INTRODUCING DIELDRIN INTO WATER,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
George G. Chadwick, and Ulo Kiigemagi.
Journal Water Pollution Control Federation, Vol. 40, No. 1, 1968, p 76-82. 2 fig, 2 tab, 2 ref. PHS Grant No. E5-00040.

Descriptors: *Evaluation, Bioassay, *Toxicity, Dieldrin, *Laboratory equipment, Gas chromatography, Pesticide residues, Pesticide toxicity, Solubility, *Solvation, Lethal limit, Reliability.
Identifiers: *HEOD, Guppies.

A system has been developed and tested for introducing dieldrin or other sparingly soluble compounds directly into water for experimental studies. Particles of sand in sand-packed glass columns were coated either with dieldrin or HEOD, and water was passed through the columns. Samples of the effluent water from the columns were tested for HEOD content by gas chromatography and for acute toxicity by bioassay with young guppies. Results of analysis of effluent samples by gas chromatography showed that the HEOD concentration remained relatively constant over a period of several months. Bioassay showed that the toxicity of effluents from columns coated with technical dieldrin was initially many times greater than the toxicity that could have been due to the HEOD present. The results of acute toxicity tests and gas chromatographic analysis of water samples indicate that the toxicity of dieldrin in water that has been in contact with dieldrin may not be predictable on the basis of chemical analysis for HEOD alone. The ratios of the concentration of HEOD to concentrations of other unidentified toxic components of dieldrin present in dieldrin-contaminated water can be highly variable. (Sjolseth-Washington)
W70-09971

5B. Sources of Pollution

ADSORPTION OF VIRUSES ON MINERAL SURFACES,
Maine Univ., Orono. Water Resources Research Center.
Otis J. Sproul.
Available from NTIS as PB-193 795, $3.00 in paper copy, $0.65 in microfiche. Project Completion Report, June 1970. 19 p, 5 tab, 6 fig, 2 ref. OWRR Project A-013-ME (3).

Descriptors: *Soil disposal fields, *Viruses, *Adsorption, *Bactiophage, Waste water treatment, Water pollution sources.
Identifiers: *Poliovirus, Minerals, Sillimonite, Enstatite, Wollastonite, Olivine, Kyanite, Microcline, Actinolite.

The specific aim was to determine the adsorption capacities of selected common minerals for viruses. Bench scale adsorption studies using T4 bacteriophage and the Type I poliovirus (Sabin Strain) and various silicate minerals have been carried out. The minerals used were sillimonite, enstatite, wollastonite, olivine, kyanite, microcline and actinolite. The size ranges for these minerals were restricted to between 1 and 10 microns in diameter. The adsorption of the bacteriophage T4 was related to the acidity of the silicate surfaces. A detailed study of the bacteriophage T4 and its adsorption on silicate minerals showed that the adsorption was related to the electrophoretic mobility. As the pH decreased the rate of virus adsorption increased at pH 4.3. There was a corresponding increase in slope in the mobility curve at this pH. At pH 3.3 the rate of virus adsorption decreased as the positive mobility declined. The adsorption of the bacteriophage T4 varied from about 50 to 99.5 percent for these minerals at pH values below 5. Slightly lower adsorption on the order of 50 to 80 percent was obtained in the adsorption of the poliovirus on the silicate minerals. These lower removals are partly attributed to the different type of virus which was used and also to the higher pH, A PH of 7.0, which was used in this work. A competitive effect on poliovirus adsorption was noted when extraneous organic materials were added either before or after the contact between the virus and the silicate material had occurred. Protein such as bovine albumin and egg albumin in concentrations of 1 and 1.5 mg/l were able to decrease the adsorption from 50 to 80 percent to as low as 12 to 20 percent. A domestic sewage secondary effluent decreased the adsorption of poliovirus by the same amount.
W70-09520

DISSOLVED OXYGEN RESOURCES AND WASTE ASSIMILATIVE CAPACITY OF THE LA GRANGE POOL, ILLINOIS RIVER,
Illinois State Water Survey, Urbana. Dept. of Registration and Education.
T. A. Butts, D. H. Schnepper, and R. L. Evans.
Report of Investigation 64, 1970. 28 p, 15 tab, 23 fig, 26 ref.

Descriptors: *Dissolved oxygen, *Nitrification, *Water quality control, Biochemical oxygen demand, Illinois, Oxygen sag, Reaeration, Rivers, Sanitary engineering, Time-of-travel, *Waste assimilative capacity, Water management, Water pollution sources, Water temperature.
Identifiers: Illinois River.

The La Grange navigation pool, a 77.4 mile reach of the Illinois River below Peoria, frequently experiences low dissolved oxygen concentrations which fall below 4.0 mg/l, the minimum standard. Weighted average DO concentrations as low as 1.65 mg/l, with a minimum DO of 0.9 mg/l, have been observed. Mathematical models were developed by statistical regression methods for predicting average and minimum pool DO concentrations. A variety of methodologies were investigated to determine the best procedure for defining the pool waste assimilative capacity; the Velz modification of the Black and Phelps procedure was selected. A quality control chart was designed to detect DO trends which deviate from expected patterns. The ability of the pool to assimilate organic wastes has been restricted because man has drastically altered the natural hydraulic and hydrologic characteristics of the river. A significant cause of DO depletion appears to be nitrification; this fact must be considered in future waste treatment requirements if significant water quality improvements are to be realized.
W70-09524

LEACHING FROM SIMULATED LANDFILLS,
Battelle Memorial Inst., Columbus, Ohio; and West Virginia Univ., Morgantown. Dept. of Civil Engineering.
Syed R. Qasim, and Jerry C. Burchinal.
Journal Water Pollution Control Federation, Vol 42, No 3, Part 1, p 371-379, March 1970. 9 p, 10 fig, 4 tab, 8 ref. USPHS Grant EF-40 (R1).

Descriptors: *Leaching, *Landfills, *Percolation, *Groundwater movement, Model studies, Laboratory tests, Path of pollutants, Water pollution sources, Self-purification, Biodegradation.
Identifiers: Simulated landfill.

Simulated landfills 3 ft in diam and 4 to 16 ft in height were filled with mixed municipal refuse. The cylinders were saturated with water and additional water added at two-week intervals. Percolated water was drained and analyzed on a regular schedule for chemical and bacterial quality. The study covered a maximum of 163 days. Concentration of extracted material increased initially but began to decrease after about four weeks. Another increase after eight weeks was evident. The concentration in the leachate of 18 organic and inorganic compounds over the period of the study is reported. pH showed a slight increase followed by a rapid decrease. Leach samples tend to undergo bacteriological and chemical self-purification. Deeper fills consume more water, before leaching occurs, take a longer time to decompose, and the bulk of the extracted material is distributed over a longer period. (Knapp-USGS)
W70-09548

CHEMICAL FALLOUT-CURRENT RESEARCH ON PERSISTENT PESTICIDES,
Rochester Univ., N.Y. Dept. of Radiation Biology and Biophysics.
For primary bibliographic entry see Field 05C.
W70-09559

CHLORINATED HYDROCARBONS IN MARINE ECOSYSTEMS,
California Univ., Berkeley. Inst. of Marine Resources.
For primary bibliographic entry see Field 05A.
W70-09560

PERSISTENCE OF PESTICIDE RESIDUES IN SOILS,
Agricultural Research Service, Beltsville, Md. Crops Research Div.
P. C. Kearney, R. G. Nash, and A. R. Isensee.
In: Chemical Fallout-Current Research on Persistent Pesticides, Proceedings Publication of Rochester Univ Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 54-67, 1969. 14 p, 3 fig, 1 tab, 26 ref.

Descriptors: *Pesticide kinetics, *Pesticide residues, *Soil chemistry, *Biodegradation, Persistence, Translocation, Toxicity, Environmental effects, Leaching.
Identifiers: Pesticide-soil interactions.

Pesticide persistence in our environment is of current national interest. The effective life of pesticides in soils varies from a few weeks to several

years. Their persistence depends primarily on the structure and properties of the compound, and to a lesser degree on location and soil properties. Extremes in persistence are found with the insecticides. The highly toxic phosphates do not persist for extended periods of time in soils. In contrast, some of the chlorinated hydrocarbon insecticides may persist for four to five years under normal rates of application. Disappearance of most complex organic pesticides from soil follows a first-order reaction curve. Disappearance of simpler organic pesticides often exhibits a lag phase followed by rapid metabolism by soil microorganisms. Heavy metals and arsenic pesticides tend to accumulate at the application site. (See also W70-09559) (Knapp-USGS)
W70-09562

CONVERSION OF MERCURY COMPOUNDS,
Institutet for Vatten och Euftvardforskning, Stockholm (Sweden).
A. Jernelov.
In: Chemical Fallout-Current Research on Persistent Pesticides, Proceeding Publication of Rochester Univ Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 68-74, 1969. 7 p, 12 ref.

Descriptors: *Path of pollutants, *Heavy metals, *Poisons, Biochemistry, Water pollution sources, Chemical wastes, Pesticides, Bottom sediments, Lakes, Water chemistry.
Identifiers: *Mercury, Methylmercury.

It is shown in Sweden that fish contain methylmercury in instances where the original discharge contains other types of mercury compounds. Mercury discharge in the form of metallic mercury, inorganic divalent mercury, phenylmercury and alkoxialkylmercury can all be converted in nature to methylmercury. (See also W70-09559) (Knapp-USGS)
W70-09563

MERCURY CONTAMINATION OF THE ENVIRONMENT IN SWEDEN,
Naturhistoriska Riksmuseet, Stockholm (Sweden).
For primary bibliographic entry see Field 05C.
W70-09565

ENTRAINMENT IN DEFLECTED AXISYMMETRIC JETS AT VARIOUS ANGLES TO THE STREAM,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
J. L. Platten, and J. E. Keffer.
Technical publication series UT Mech E TP 6808, June 1968. 53 p, 9 fig, 1 tab, 15 ref.

Descriptors: *Jets, *Mathematical models, Porosity, Density, Water circulation, Shear, Vortices, Velocity, Turbulence, Stream flow, Simulation analysis, Winds, Uniform flow.
Identifiers: Entrainment.

A mathematical model for the round turbulent jet in a cross-wind is proposed. The analysis accounts for varied initial angle of injection to the uniform stream and incorporates a function which attempts to simulate the two entrainment processes suggested by observation of the real flow. The first of these is the growth of a turbulent field such as in ordinary jets and wakes, arising from the presence of a mean velocity difference. The second mechanism, peculiar to the deflected jet is the entrainment stemming from the presence of a vortex pair. Because of the shearing action of the cross-wind on the jet, a circulation is generated and fluid is swept into the wake regions of the flow. The model is applied to experimentally determined jet centre lines for a number of velocity ratios and initial angles of injection. The resulting entrainment parameters were found to be invariant within initial angles of plus or minus 15 deg to the normal jet and only moderately invariant up to plus or minus 45 deg. (Osborne-Vanderbilt)
W70-09603

COASTAL ENTRAPMENT IN LAKE HURON,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 02H.
W70-09606

THERMAL EFFECTS AND NUCLEAR POWER STATIONS IN THE U.S.A.,
Atomic Energy Commission, Washington, D.C.
R. E. Nakatani, D. Miller, and J. V. Tokar.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/30. 14 p, 1 tab, 21 ref. Preprint.

Descriptors: *Thermal pollution, *Nuclear power plants, *Cooling water, *Water temperature, Condensers, Design, Standards, Fish kill, Algae, Cooling towers, Density, Viscosity, Fish behavior, Fertility, Seasonal, Diffusivity.
Identifiers: *Waste heat, Sublethel effects, Mixing zones, Modeling.

Nuclear power plants in the U.S. were surveyed that are either operable, being built, or planned as of December 31, 1969. Over sixty percent of the plants used the once-through system where the condenser cooling water was taken from nearby rivers, lakes, estuaries, or the ocean and then usually returned to the same source. The average maximum temperature rise across the nuclear power plant condenser was approximately 10 degree C. General observations and recommendations based on statements describing the planning, design, and procedures for waste heat release and information obtained from personal plant visits include: (1) thermal quality standards are becoming increasingly stringent; (2) fish kills are rare and their severity limited; (3) studies of the short- and long-range movement and effects of heat should be undertaken; (4) the effort should be made to acquire knowledge of the sublethel effects of releasing heat; (5) alternate methods for releasing waste heat should and are being employed; (6) the need for stochastic and analytic models of plume behavior exists. (Osborne-Vanderbilt)
W70-09612

IMPROVED METHODS FOR PLANNING OF THERMAL DISCHARGES BEFORE SITE AQUISTION WITH A SPECIFIC CASE EXAMPLE ON THE COLUMBIA RIVER,
Battelle Memorial Inst., Richland, Wash.
For primary bibliographic entry see Field 04A.
W70-09613

STORM WATER POLLUTION FROM URBAN LAND ACTIVITY,
AVCO Economic Systems Corp.
Jerry G. Cleveland, Ralph H. Ramsey, and Paul R. Walters.
Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows', p 1-56, June 22-23, 1970. 6 fig, 14 tab, 4 ref. FWQA Contract 14-12-187.

Descriptors: *Storm runoff, *Water analysis, Pollution abatement, Drainage, Control, Water quality, Cities, Surface runoff, Precipitation, Analytical techniques, Land use.
Identifiers: Tulsa, Oklahoma.

An assessment of pollution in storm water as it relates to land activity is described. The central purpose of this effort was to design a method of analysis which would enable the city planner and engineer to assess the quality as well as quantity of storm water and to do so by looking at land activity, selected environmental factors, and precipitation. The scope of the project included a field assessment of the storm water pollution by obtaining samples of the water resulting from precipitation and surface runoff from selected areas in the Tulsa, Oklahoma metropolitan area; development of an analytical procedure for correlation of storm water pollution with selectively defined variables of land uses, environmental conditions, drainage characteristics, and precipitation; and development of a plan for implementing remedial measures necessary to abate or control sources of pollution in an urban area. Storm water runoff samples were collected from 15 'discrete' test areas. These samples were analyzed in terms of quality standards for BOD, COD, TOC, organic Kjeldahl nitrogen, soluble orthophosphate, chloride, pH, solids, total coliform, fecal coliform, and fecal streptococcus pollutants. Three approaches are recommended to abate and control the pollution load of storm runoff. These are: a reduction in total runoff, a reduction in runoff rates, and environmental policy. (See also W70-09558). (Marriott-Chicago)
W70-09615

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWERS BUCYRUS, OHIO,
Burgess and Niple Ltd., Columbus, Ohio.
Richard F. Noland, and Dale A. Decarlo.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 291-320, June 22-23, 1970. 16 fig, 3 tab. FWQA Contract 14-12-401.

Descriptors: *Overflow, *Storm drains, *Sewers, *Water pollution control, Engineering, Analytical techniques, Sampling, Urbanization, Ohio.
Identifiers: Combined sewer overflow, Lagoon system, Interceptor sewer, Bucyrus (Ohio), Sandusky River.

Results are described of a detailed engineering investigation and comprehensive technical study to evaluate the pollutional effects from combined sewer overflows on the Sandusky River at Bucyrus, Ohio which is tributary to Lake Erie. A year long detailed sampling and laboratory analysis program was conducted on the combined sewer overflows in which the overflows were measured and sampled at three locations comprising 64% of the City's sewered area and the river flow was measured and sampled above and below Bucyrus. The results of the study show that any 20-minute rainfall greater than 0.05 of an inch will produce an overflow. The combined sewers with overflow about 73 times each year discharging an estimated annual volume of 350 million gallons containing 350,000 pounds of BOD and 1,400,000 pounds of suspended solids. A method of controlling the pollution from combined sewer overflows is presented along with the degree of protection, advantages, disadvantages and estimate of cost. The method presented is an interceptor sewer and lagoon system. The most economical method of providing a high degree of protection to the Sandusky River is by collecting the combined sewer overflows with a large interceptor and using an aerated lagoon system to treat the waste lands from the overflows. (See also W70-09558). (Marriott-Chicago)
W70-09621

HYDROGEOLOGY OF SOLID WASTE DISPOSAL SITES IN NORTHEASTERN ILLINOIS,
Illinois State Geological Survey, Urbana.
G. M. Hughes, R. A. Landon, and R. N. Farvolden.
Available from Bureau of Solid Waste Management, 5555 Ridge Ave, Cincinnati, Ohio, 45213. U. S. Department of Health, Education, and Welfare, Bureau of Solid Waste Management, 1969. 137 p, 24 illus, 9 tabs, 3 ref. No. DO I - UI - 00006.

Descriptors: *Hydrogeology, *Solid wastes, *Landfill, *Infiltration, *Water quality pollution, Recharge, Discharge, Groundwater, Surface waters, Aquifers, Flow rates, Leaching.
Identifiers: Northeastern Illinois.

This project describes the hydrogeologic environments in the vicinity of four existing landfill sites in the Chicago Metropolitan area, in order to determine the controls on the movement of the ground water and the solids dissolved in ground water. Groundwater recharge and discharge areas are

ned and the quantities of water moved and s of movement through various materials and in ous environments have been estimated. Infor- ion from this preliminary study can be used by ılatory agencies to help determine environ- nts most suitable for near-surface disposal of te insofar as contamination of groundwater and face water is concerned. The problem of undwater contamination by near-surface solid te disposal is approached in terms of the rogeologic environment. In some sites, water t infiltrates the ground becomes part of a local v system and is discharged into a nearby stream swamp with little risk of contaminating an ifer. In other sites this water becomes part of a ional flow system and may enter productive ifers with definite risk of contamination. The inition of flow systems in homogeneous materi- is relatively simple; however, the effects on this w system of changes from one geologic material another are more difficult to evaluate. This in- mation is necessary if movement of refuse chate from proposed disposal sites is to be pre- ted. (Marriott-Chicago)
70-09637

OBLEM: HARBOR DEBRIS,
fice of the Chief of Engineers (Army), Washing- n, D.C. Civil Works Directorate.
gene B. Conner.
Water Spectrum, Issues, Choices, Actions, Vol. No. 1, Spring 1970, p 9-13. 8 photo.

escriptors: *Aquatic drift, *Harbors, *On-site ta collections, *Safety, *Navigation, Flotsam, annels, Channel improvement, Cost-benefit alysis, Ordinances, Legislation, Urbanization, nd use, Public health, Governments, Planning, nvironment, Water pollution.
entifiers: *New York Harbor, *'Sweepers', *De- tering, *Harbor debris, Environmental quality, ooperative governmental program.

e-littering in the Nation's 250 harbors and chan- els is a staggering chore. In a survey of New ork's harbor and tributaries, 2,000 abandoned essels and over 2,300 shore structures and cluster f floatable debris were found to be potential drift ources. Sweeping boats removed some debris but ousands of accidents still occurred every year ausing expensive damage and danger. Two eneral approaches offered solutions to the drift roblem: (1) to increase removal and disposal of oating debris above present level, and (2) to liminate the sources of drift by removal or repair f derelict vessels and structures. Cost-benefit anal- sis showed the latter to be best. Costs of removal nd repair were estimated at $29 million and an an- ual cost of 1.5 million, while monetary benefits ould be over $10 million a year as well as other enefits of reduction in fire hazards, air and water ollution, hazards to life and health and improved ppearance of the waterfront. A national survey ecommends an aggressive program to remove ources of drift. Such a program offers an opportu- nity for cooperation between Federal, State and ocal governments to improve the quality of urban nvironment. Successful implementation, requiring enactment and enforcement of local ordinances to regulate sources of drift, would greatly help in re- lieving conditions of waterfront decay, ugliness and blight, free waterside sites for functions having positive effects on their neighborhood areas; and bring about higher levels of usefulness and safety for both commercial and recreational users of our Nation's vital waterways and harbors. (Marriott-Chicago)
W70-09640

COMPARISON OF THE WATER QUALITY OF THE BOIS BRULE AND POPLAR RIVERS, WISCONSIN - BOTH TRIBUTARY TO LAKE SUPERIOR,
Wisconsin State Univ., Superior. Center for Lake Superior Environmental Studies.
For primary bibliographic entry see Field 05A.
W70-09674

DEVELOPING A HYDRO-QUALITY SIMULATION MODEL,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-09740

RADIONUCLIDE TRANSPORT AND RESPONSES TO ORGANIC STRESS IN A RESEARCH FLUME,
Texas Univ., Austin.
E. F. Gloyna, Y. A. Yousef, and T. J. Padden.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 13 p, 7 fig, 4 tab, 13 ref.

Descriptors: *Flumes, *Streams, *Mathematical model, *Plants, *Sediments, Ecology, Toxicity, Water pollution sources, *Ecosystems.
Identifiers: Organic stress, *Radionuclides, *Activity systems.

Small ecosystems established in aquaria, control reservoirs, and large flumes are useful tools for simulating stream processes and evaluating the complex factors which interact with various pollutional stresses. By simulating the physicochemical characteristics of an aquatic system the flume can be used to determine the interrelationships between atmospheric reaeration, photosynthesis, respiration, organic load, biomass, and sediments. Measurements of responsed of the aquatic system to conventional pollutional stresses and radionuclide behavior can and has been shown to aid in the development and verification for prediction models. The principal mechanism of radionuclide transport is hydrodynamic, however, other influences of the rate of movement are: (1) the amount and type of suspended matter, (2) chemical character of the bottom sediment and aqueous system and (3) surface and concentration of radionuclide of both the dead sediments and biomass. The organic suspension when compared on a unit weight basis tended to sorb 103Ru in much larger amounts than inorganic suspensions. Sorption of 137Cs by clay suspensions was a function of the amount and type of clay in suspension. The amount of radionuclide retained by dead sediment is a function of organic pollution. Side-wall temperature must be controlled carefully in small-scale systems to prevent convection currents, particularily if controlled by atmospheric aeration is important. (Hancuff-Texas)
W70-09743

A MATHEMATICAL MODEL OF SELF-PURIFICATION PROCESS IN A CANALIZED HIGHLY POLLUTED RIVER,
Water Economics Research Inst., Wroclaw (Poland).
For primary bibliographic entry see Field 05D.
W70-09765

THE PERSISTENCE OF PESTICIDES IN IMPOUNDED WATERS,
Kentucky Water Resources Inst., Lexington.
Robert A. Lauderdale.
Available from NTIS as PB-194 056, $3.00 in paper copy, $0.65 in microfiche. Kentucky University Water Resources Institute Research Report No 17, 1969. 39 p, 8 fig, 5 tab, 8 ref. OWRR Project No A-002-Ky (4).

Descriptors: *Water pollution effects, *Pesticides, Residues, *Pesticide kinetics, *Persistence, Evaporation, Biodegradation, Adsorption, Algae, Clays, Aldrin, Dieldrin, DDT, Aeration, Silts.
Identifiers: Chlordane.

The persistence of the insecticides aldrin, dieldrin, chlordane, and DDT in water were measured. A small area was sprayed with these compounds, and the insecticides were collected in the runoff water from the area. Laboratory experiments were performed to determine the effectiveness of aeration, adsorption on silt, and adsorption on algae in removing the pesticides from water. All of the pesticides were found in samples of water collected for the full period of the tests. The amounts which were found in a small pond into which the surface water drained was consistently less than that found in the surface runoff water itself. The reduced concentrations in the pond water were apparently the result of a combination of sedimentation, adsorption on algae or silt, or volatilization of the insecticide from the water into the atmosphere. In general, the efficiency of removal of insecticide from water by any one of these processes appears to be low. However, because of the large ratio of absorbant to insecticide, the overall removal is substantial. (Knapp-USGS)
W70-09768

WATER QUALITY SURVEY OF THE POTOMAC ESTUARY - 1965-1966,
Federal Water Pollution Control Administration, Annapolis, Md. Chesapeake Technical Support Lab.
For primary bibliographic entry see Field 05A.
W70-09769

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.

Supplementary Report, June 1970. 56 p, 52 fig. Repair Work in Conjunction with Community Renewal Program Project No. La-R-6 (CR).

Descriptors: *Repairing, *Sewers, *Leakage, *Inflow, *Water pollution control, *Pollution abatement, *Drainage systems, *Storm drains, *Drainage systems, *Municipal wastes, *Sewerage, *Pumping plants, *Disinfection, *Chlorination, *Water quality control, Waste water treatment, Path of pollutants, Lakes, Infiltration.
Identifiers: *Sewer repairs, *Leakage repairs, *Pipe repairs, *Sewer repair costs, *Storm water pollution, *Sewer inspection, *Sewer leakage, *House sewers, Lake Pontchartrain, New Orleans, Televised inspections.

The results were evaluated of sewer repairs that were made by the New Orleans Sewerage and Water Board to correct major leaks and defects found using television equipment. Field inspection work was conducted in 1969 to determine how and to what extent the storm waters discharged to Lake Pontchartrain are being polluted by domestic sewage. The results were published in a basic report, having the same title as this supplementary report, dated June 1970. Upon completion of the repairs of 47 major defects, exfiltration tests were made on the repaired lines. The results indicated excessive leakage still existing. There must be considerable leakage from unrepaired house sewer connections. If all house connections 20 years or older are repaired, the costs would be over $30 million. Other actions planned or underway include: relining existing sewer pipes with flexible thin plastic pipe; construction of a new sewer line to eliminate discharges of contaminated sewage from overloaded pumping stations; and installation of disinfection facilities at sewage pumping stations, using sodium hypochlorite. A unique plant for preparing the chemical was constructed. Television photographs of pipe leakage and exfiltration data are included. (Poertner)
W70-09801

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.

Final Report, June 1970. 117 p, 29 fig, 49 tab, 14 ref. Community Renewal Extension Project No. La-R-6 (CR).

Descriptors: *Pollutant identification, *Water pollution, *Path of pollutants, *Water pollution control, *Pollution abatement, *Leakage, *Storm drains, *Drainage systems, *Sewers, *Municipal wastes, *Inflow, *Sewerage, *On-site investigations, *Lakes, *Water quality control, Inspection,

On-site tests, Repairing, Infiltration, Dye releases, Cracking, Pumping plants, Design standards, Installation.
Identifiers: *Storm water pollution, *Sewer leakage, *Cross flow, *Televised inspections, *House sewers, *Cross connections, *Sewer inspection, Lake Pontchartrain, New Orleans, Infiltration tests.

The findings are presented of field inspections of the operating condition of sanitary sewers and storm sewers in New Orleans to determine how, and to what extent, the storm waters discharged to Lake Pontchartrain are being polluted with domestic sewage. Television cameras were pulled through sewers to view leakage into sewer pipes at open joints, fractures and house connections. Leakage between 8 inch diameter sanitary sewers and storm sewers were first studied carefully by means of conducting exfiltration tests in selected city blocks where both sanitary and storm sewers are present. It was found that the major source of storm water pollution came from accidental cross flows between sanitary sewer house connections and storm sewers at points of crossing, particularly where house sewers cross beneath storm sewers. These cross flows resulted from broken or cracked pipes and pipe joints in both systems. The fractures are attributed to the weight of the overlying storm sewer on the house connections beneath. Soil settlements caused the storm sewers to settle until they exerted forces on these pipes. Recommendations are given for the design and installation of sanitary sewers, house connections, and storm sewers. Explanation of field inspection procedures and television inspection data are included. (Poertner)
W70-09802

INTERMEDIATE PRODUCTS IN THE BACTERIAL DECOMPOSITION OF HEXADECANOL AND OCTADECANOL,
Texas A and M Univ., College Station.
W. D. Langley.
Available from the NTIS as PB-194 237, $3.00 in paper copy, $0.65 in microfiche. Texas A and M University Water Resources Institute Technical Report TR-29, June 1970. 59 p, 13 fig, 4 tab, 16 ref. OWRR Project No A-012-Tex (1).

Descriptors: *Biodegradation, *Hexadecanol, *Octadecanol, *Monomolecular films, Alcohols, Evaporation control, Analytical techniques, Sampling, Bacteria, Aquatic microbiology, Chromatography.
Identifiers: Gas-liquid chromatography.

The biodegradation of the monolayer film-forming chemicals hexadecanol and octadecanol were related to water quality factors. Detection, identification, and behavior of any intermediate or end product compounds formed as a result of the biological transformation of the hexadecanol or octadecanol were investigated. The behavior of long chain fatty alcohols was correlated with published analyses of lower molecular weight alcohols. Straight chain primary alcohols appear to represent a competitive substrate system with respect to microbial selectivity. In the presence of branched chain primary alcohols, the straight chain forms appear to constitute a preferred substrate system. The branched chain primary alcohols are biodegradable; their rate of degradation is however, retarded. (Knapp-USGS)
W70-09829

POWER LAW SOLUTIONS FOR VERTICAL PLUMES,
California Univ., Irvine. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W70-09840

SIGNIFICANCE OF DDT RESIDUES FROM THE ESTUARY NEAR PENSACOLA, FLA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla., Center for Estuarine and Menhaden Research, Breeze, Fla.
David J. Hansen, and Alfred J. Wilson, Jr.
Pesticides Monitoring Journal, Vol 4, No 2, p 51-56, September 1970. 6 p, 1 fig, 2 tab, 6 ref.

Descriptors: *Pesticide residues, *Fish, *Florida, *DDT, *Estuaries, Path of pollutants, Toxicity, Persistence, Water pollution sources.
Identifiers: Pensacola Bay (Fla).

Pesticide residues in fishes from the estuary near Pensacola, Fla., monitored from April 1964 to November 1965, are compared with residues in fishes exposed to DDT in the laboratory. DDT in fish exposed to 0.1 ppb p,p'-DDT 5 weeks failed to increase after the second week, when maximum concentrations reached 38,000 times that in the test water. Loss of DDT from these fish was slow, 78%-87% in 8 weeks. The amounts of DDD or DDE in fish did not increase either during or after exposure. Residues in fish from the estuary rarely exceeded 0.1 ppm except in those collected from the lower estuary in the summer and fall when the amount of DDT and its metabolites reached 1.3 ppm. Fish from the lower estuary had more DDT and less DDD and DDE than fish from the upper estuary. The DDT content in lower estuarine fish increased in July, August, and September. One source of DDT was a county-sponsored spray program centered in the lower estuary in July and August. (Knapp-USGS)
W70-09847

DIFFUSIVE PROPERTIES OF INTERFACIAL LAYERS,
Chalmers Univ. of Technology, Goteborg (Sweden). Hydraulics Div.
Anders Sjoberg.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D8, p 71-78, 1967. 8 p, 5 fig, 11 ref.

Descriptors: *Stratified flow, *Density stratification, *Thermal stratification, *Mixing, *Path of pollutants, Dispersion, Diffusion, Turbulence, Turbulent flow, Fjords, Interfaces, Shear.
Identifiers: Sweden.

The Swedish coastal waters - particularly on the West Coast - have a pronounced density stratification. It is possible to design a submarine outfall in such a way that a submerged sewage field is established. It is necessary to know how the vertical stability of such a submerged sewage field is affected by surface currents, wind generated waves, and turbulence at the bottom. The few experimental investigations of stratified flow which a theory can be based on are reviewed and as much information as possible is extracted from these investigations. Experimental data are presented in a manner suitable to the description of turbulent transfer of matter and momentum across interfaces. (Knapp-USGS)
W70-09867

BIOLOGICAL IMPLICATIONS OF A MARINE RELEASE OF Sr-90,
Naval Radiological Defense Lab., San Francisco, Calif. Biophysics Branch.
Burton E. Vaughan, and John A. Strand.
Health Physics, Vol 18, p 25-41, 1970. 4 fig, 4 tab, 65 ref.

Descriptors: *Strontium radioisotopes, *Sea water, *Biota, Radioactivity, Mathematical models, Water pollution sources, Coasts, Kinetics, Fish, Food webs, Economic impact, Industries, Benthos, Monitoring, Carnivores, Scavengers, California, Phytoplankton, Zooplankton, Detritus, Bacteria, Herrings, Crabs, Clams, Oysters, Shrimp, Fisheries, Crustaceans, Mollusks, Proteins, Rhodophyta, Phaeophyta, Gamma rays, Radioisotopes, Marine animals, Adsorption, Model studies.
Identifiers: *Radio contamination, Operation Swordfish, Pelagic organisms, Sessile organisms, Migratory organisms, Migratory interception, Filter feeders, Radioactive pool size, Biological monitoring, Kelp, Seaweeds, Gelidium cartilagineum, Macrocystis pyrifera, Alginic acid, Agar, Mucopolysaccharidic envelope, Ulva.

For a situation represented by instantaneous release of strontium-90-oxide in the ocean, a model of biotic radiocontamination has been devised based more realistically on known characteristics of coastal marine organisms. In this contamination model radioactivity concentration in soft tissues of migratory fish has been determined by pool radioactivity using a modified Carter-Okubo diffusion model, uptake and concentration kinetics, and migratory interception as a function of pool size. Reasonably good validation was provided by information available from Operation Swordfish, and differences in Operation Swordfish release and a hypothetical release of strontium-90-oxide were examined. For 750 curies of strontium-90-oxide released, probably contamination of economically important pelagic fish would be accordingly less than consequent on a water concentration maintained at 1 million parts/cubic centimeters. Certain limitations as to generalizing this model are discussed. The problems arising chiefly concern behavior of sedentary organisms, and biological uptake during very protracted release conditions. In these two cases present state-of-the-art does not permit adequate assessment of radiocontamination. The localized release considered here cannot constitute a potential hazard to man if normal radiation protective actions are implemented. (Jones-Wisconsin)
W70-09903

PROPOSED PLANS FOR SEWAGE DISCHARGE FROM THE GOTHENBERG REGION, SWEDEN,
Goteborg Water and Sewage Authority (Sweden).
For primary bibliographic entry see Field 05D.
W70-09942

TRANSFORMATION OF RIVER WATER AT THE MOUTH OF A RIVER AND SOME CRITERIA OF POLLUTION,
State Oceanographic Inst., Moscow (USSR).
For primary bibliographic entry see Field 02K.
W70-09946

APPLIED RESEARCH ON MARINE SEWAGE DISPOSAL FROM THE GOTHENBURG REGION, SWEDEN,
Stockholm Univ. (Sweden). International Meteorological Inst.
L. Arnborg, and E. Eriksson.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 7 p, 7 fig.

Descriptors: *Research and development, *Water pollution, Phosphorus, Thermal stratification, Currents (Water), Algae, Lakes, Rivers, Sewage disposal, Sewage treatment, Waste water treatment.
Identifiers: *Marine disposal, *Gothenbrug, Sweden.

The city of Gothenburg at the west coast of Sweden plans to construct a system of intercepting sewers and rock tunnels by which all the sewage from the city can be conveyed to a treatment plant. After biological treatment, the sewage can be discharged either into the river mouth or into the sea outside a nearby archipelago. In order to compare the different outfall sites, an investigation of the area was undertaken from the mouth of the river, Gota Alv, through the archipelago into the open sea. The mean values and standard deviations of the vertical distribution of temperature, salinity and density during summer and winter in the area outside the archipelago are presented graphically. Large variations of current patterns take place due to tides, winds, and variations in the atmospheric pressure. The main directions of the currents are North and South with the resultant to the North. A figure is

sented showing the frequencies spectrum densi- The study of the use of a diffuser system for the persal of treated sewage resulted in the following sign and conclusions: The area of release is 3 km st of the archipelago. The diffuser portholes are m in diameter and located 30 to 35 m below the face. The initial velocity through the portholes l be 2.5 meters/second. With this arrangement d the existing vertical density stratification the m will rise to a level of 14 to 20 meters below surface. (Hancuff-Texas)
70-09947

TERNATIONAL SHOE CO V HEATWOLE RIVATE CAUSE OF ACTION FOR POLLU-ON).
r primary bibliographic entry see Field 06E.
70-09983

C. Effects of Pollution

HEMICAL FALLOUT-CURRENT RESEARCH N PERSISTENT PESTICIDES,
ochester Univ., N.Y. Dept. of Radiation Biology d Biophysics.
orton W. Miller, and George G. Berg.
pringfield, Illinois, Charles C. Thomas, Publisher, 969. 531 p.

escriptors: *Pesticide toxicity, *Persistence, *Enronmental effects, *Path of pollutants, Pesticide netics, Water pollution sources , Chlorinated ydrocarbon pesticides, DDT, Dieldrin, Water polion effects, Ecology, Birds, Fish, Balance of naire, Biology, Food chains, Lakes, Oceans, Estuaes, Productivity, Heavy metals, Poisons.
lentifiers: Pesticide effects (Ecological), Mercury.

symposium was held on the topic of the effects of ersistent pesticides on ecological systems, includng effects on man. Five sections are arranged in a equence that follows pesticides from their entry nto the ecological systems to their ultimate effects n the human population. The ecological fate of esticides is narrowed from ecosystems to single opulations and their relationships to economic, olitical-administrative, and agro-ecological social ubsystems. Examples are given of the way in which he interplay of economics and politics makes cology a more complicated study to government nd industrial scientists than to university-based cologist. The mechanism of damage in individuals s examined. Protecting human populations from damage caused by these persistent pesticides is discussed by the editors. (See also W70-09560 thru W70-09565) (Knapp-USGS)
W70-09559

CONVERSION OF MERCURY COMPOUNDS,
Institutet for Vatten och Euftvardforskning, Stockholm (Sweden).
For primary bibliographic entry see Field 05B.
W70-09563

THE SIGNIFICANCE OF DDT RESIDUES IN ESTUARINE FAUNA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Biological Lab.
For primary bibliographic entry see Field 05A.
W70-09564

MERCURY CONTAMINATION OF THE ENVIRONMENT IN SWEDEN,
Naturhistoriska Riksmuseet, Stockholm (Sweden).
A. G. Johnels, and T. Westermark.
In: Chemical Fallout-Current Research on Persistent Pesticides, Proceedings Publication of Rochester Univ Conferences on Toxicity: Springfield, Ill, Charles C. Thomas Publisher, p 221-241, 1969. 21 p, 8 fig, 6 tab, 21 ref.

Descriptors: *Heavy metals, *Poisons, *Pesticide residues, *Water pollution sources, *Persistence, Biochemistry, Path of pollutants, Chemical wastes, Aquatic environment, Environmental effects, Toxicity, Water pollution effects, Fish, Birds.
Identifiers: Mercury.

Mercury and mercury compounds have a wide use in agriculture and industry, and an increase in natural levels of mercury content has been recorded. By means of activation analysis, the mercury content in feathers of eleven Swedish terrestrial bird species was studied. The material was derived from museum collections and from living or freshly killed birds; it covers a period of more than 100 years. These studies reveal nearly constant mercury levels from the middle of the previous century until 1940. After that, a well-documented increase in mercury concentration occurs, amounting to at least ten to twenty times the previous level. In 1940 alkylmercury compounds began to be used as seed dressings. The mercury content in axial musculature of pike (Esox lucius) has been used for estimating the level of mercury in the aquatic environment. Two fish-eating bird species show a gradual increase in mercury content since the previous century. (See also W70-09559) (Knapp-USGS)
W70-09565

POSSIBILITIES FOR BENEFICIAL USES OF HEATED WATER DISCHARGES INTO COOLING RESERVOIRS,
Missouri Univ., Columbia. Dept. of Zoology.
Robert S. Campbell, Arthur Witt, Jr., and James R. Whitley.
Fifth Annual Water Resources Research Conference, Feb. 3-4, 1970, Washington, D.C., U.S. Dept. of Interior, Office of Water Resources Research, June 1970. p 57-64, 27 ref.

Descriptors: *Heated water, *Beneficial use, *Cooling water, *Fisheries, Water quality, Fish attractants, Fish harvest, Plankton, Benthic fauna, Algae, Ecology, Missouri.
Identifiers: Cooling reservoir, Artificial reservoir, Montrose Lake, Thomas Lake.

Montrose Lake and Thomas Lake in Missouri were studied. Both were artificial cooling reservoirs. Studies included water quality, primary production of algae, plankton and bottom fauna and fish. Impact of heated water upon the ecology of a reservoir will be lessened as the volume of the reservoir is increased. Employment of a long cooling canal results in loss of heat to the atmosphere prior to discharge into the reservoir. Under the conditions existing in Thomas Hill Reservoir, no lethal effects from heated water inflow was observed. Beneficial effects which may be derived from controlled discharge of heated water are: (a) Migration of fishes may result in a buildup of fish densities. (b) The increased density of fishes may provide an extended harvest into the winter period. (c) Continued growth of game fishes may occur during the winter period. (d) An increased production of commercially raised fish may be possible. (e) The location of the power plant might be planned to provide optimal conditions for fish harvest and for use of heated water effluent in hatchery and rearing pools. (Hsieh-Vanderbilt)
W70-09596

BENEFICIAL USE OF WASTE HEAT IN AGRICULTURE,
Oregon State Univ., Corvallis. Dept. of Soils.
For primary bibliographic entry see Field 03C.
W70-09597

CHANGING CLIMATE,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 02A.
W70-09599

PLUME EFFECTS OF NATURAL DRAFT HYPERBOLIC COOLING TOWERS,
Gilbert Associates, Inc., Reading, Pa.; and Metropolitan Edison Co., Reading, Pa.
Robert F. Visbisky, George F. Bierman, and Carroll H. Bitting.
Gilbert Associates, Inc. Interim Report. 11 p, 4 fig, 1 ref.

Descriptors: *Cooling towers, *Fog, *Aerial photography, *Statistical models, Meteorological data, Weather patterns, Micrometeorology, Heat transfer, Momemtum transfer, Wind velocity, Temperature, Humidity, Computer models.
Identifiers: *Visibility, Plume.

Preliminary investigations of the effects of cooling tower plumes were performed by various methods such as photography, mathematical modeling and meteorological measurements. The results of the studies to date indicate that cooling tower plumes will, at times, contribute to local cloud formations in varying degrees, depending on atmospheric conditions. The degree of this contribution does not appear to have a significant effect upon the operation of an airport approximately 2 1/4 miles from the plant site. The airport is not located in the predominant downwind direction. Temperature and relative humidity measurements by aircraft at low altitudes are presently being analyzed. The correlation of this information with data already accumulated by other means will further refine the predicted plume characteristics for this particular location. Generally speaking, investigative work has only begun and much more will have to be accomplished. (Hsieh-Vanderbilt)
W70-09604

EFFECTS OF HEATED DISCHARGES ON THE AQUATIC ENVIRONMENT THE TVA EXPERIENCE,
Tennessee Valley Authority, Chattanooga.
M. A. Churchill, and T. A. Wajtalik.
Proceedings, American Power Conference, 1969, Vol 31. 9 p, 9 fig, 1 tab. Also (in slightly different version) in Nuclear News, Sept. 1969, p 80-86. 6 fig, 6 tab.

Descriptors: *Thermal pollution, *Heated water, *Thermal powerplants, *Nuclear powerplants, *Water temperature, *Aquatic life, Tennessee Valley Authority Project, Isometherms, Fish, Periphyton, Benthic fauna, Zooplankton.
Identifiers: *Temperature distribution.

Since 1955, TVA has been observing the distribution in streams and reservoirs of heated waters discharged from TVA's thermal-electric powerplants. Detailed biological surveys have been made at all of TVA's steam plants except the Shawnee located on the Ohio River. No significant effects on aquatic life have been found except at the Paradise plant on the small Green River in Kentucky. Here, observed effects on fish-food organisms indicated more control of maximum stream temperatures to be desirable. Cooling towers have been built here. At the two nuclear power plants now under construction, multiport diffusers on the bottom of the old river channel in the receiving reservoirs will provide diffusion and rapd mixing. Stream temperatures will not be allowed to increase more than 10F, nor to exceed 93 F, at any time. (Hsieh-Vanderbilt)
W70-09605

THE THERMAL ENRICHMENT OF AQUATIC HABITATS,
Central Electricity Generating Board, Berkeley (England).
R. SA. Beauchamp, F. F. Ross, and J. W. Whitehouse.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 13 ref.

Descriptors: *Heated water, *Beneficial use, *Water temperature, *Heat resistance, Fish, Salmonids, Powerplants, Bottom sediments, Oxygen sag, Plankton, Benthos, Ecology.

This paper is concerned with power station cooling water discharges into rivers, lakes, estuaries and marine waters, and their effects on the ecology of such waters. Eighteen years' work by the biologists of the C.E.G.B. and its predecessors in title are summarized. The use of river water usually improves its quality and capacity to support a variety of aquatic life. In freshwater there would appear to be few problems, provided the temperature does not exceed the appropriate limit for the fish concerned, with no limitation on temperature-rise. It has to be established whether it is justifiable to install expensive engineering works to restrict maximum temperatures to less than 30C in marine waters. It will be economically advantageous to discharge a small quantity of cooling water per kwh at a higher temperature than has been the practice hitherto. If this discharged warm water is spread out over the surface of the estuary it will cool rapidly, no harm to fish will result, and the benthos will not be affected. (Hsieh-Vanderbilt)
W70-09608

COOLING WATER OUTLET IN A STRATIFIED RECIPIENT,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden).
I. Larsen.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 4 p, 1 fig, 2 ref.

Descriptors: *Cooling water, *Density stratification, *Thermal stratification, *Intakes, *Outlets, Nuclear powerplants, Mixing, Convection, Turbulence, Salinity, Winds.
Identifiers: *Selected withdrawal.

An outlet of cooling water from a nuclear power plant into a receiving water with a marked stratification due to differences in salinity is discussed. Due to this stratification, a low temperature of the cooling water at the bottom intake can be secured and recirculation of heat can be avoided. The spreading of the heated water is affected by the stratification. (Hsieh-Vanderbilt)
W70-09609

THE IMPACT OF ENVIRONMENTAL RADIATION AND DISCHARGE HEAT FROM NUCLEAR POWER PLANTS,
Westinghouse Electric Corp., Pittsburgh, Pa.
J. H. Wright, J. B. F. Champlin, and O. H. Davis.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/20. 21 p, 6 fig, 1 tab, 6 ref. Preprint.

Descriptors: *Nuclear power plants, *Radiation, *Cooling water, *Heated water, Fish, Radioisotopes, Potable water, Cyanophyta, Chlorophyta, Oxygen sag, Aquatic environment, Biochemical oxygen demand, Water temperature, Nutrient requirements, Metabolism, Fishkill, Shellfish.
Identifiers: *Federal Radiation Council.

The exposure to the general public from maximum AEC emissions is between 1 and 5 mrem/year. A large nuclear reactor would have to operate with all of the fuel in a failed and leaking condition in order to develop the maximum isotope release allowed. More than 1000 large nuclear plants could be operating on the same site at the level of 1% failed fuel without exceeding the FRC recommended exposure to the nearby general public. The average nuclear powerplant cooling ponds yield an exposure of only .12 mrems per year to a person who obtains his average fish diet from the small pond plus all of his drinking water. Heat discharge from nuclear power plants has also caused negligible change in the aquatic ecosystem. However, a river already high in biological oxygen demand from raw sewage and industrial wastes may develop an oxygen sag, below the life support level is subjected to the further stress of heated discharges. A shift in temperature of 8 deg C is all that is required to alter optimum production temperature from green to blue-green algae, if nutrient levels will also support the bloom. (Osborne-Vanderbilt)
W70-09610

DOES INDUSTRIAL COLEFACTION JEOPARDIZE THE ECOSYSTEM OF A LONG TIDAL RIVER,
Connecticut Yankee Atomic Power Co., Haddam.
Daniel Merriman.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/31. 33 p, 5 fig, 1 tab, 45 ref. Preprint.

Descriptors: *Nuclear power plants, Effluents, Water temperature, Benthic fauna, Fish kill, Salmon, Cost-benefit ratio, Ecosystem, Smolt, Catfish, River flow, Hydrologic data.
Identifiers: *Colefaction, Connecticut River, Shad, Marasmus.

The Connecticut Yankee Atomic Power Company discharges its effluent into the Connecticut River at a temperature of 12.4 degree C above that at intake and at a rate of 1400 m cu/min. To determine the effects of the effluent, the preoperative phase while the plant was being built (1965-1967) was compared with the operative phase (1968-present). Included in this comparison were present and past studies of physical and chemical characteristics of the lower reaches of the river, of the benthic fauna, of the population dynamics of the resident fish fauna, and of the fish kills. Salmon restoration in the river would not be affected by electric generating plants. River water was being effectively used for the production of electricity with minimum harmful environmental disruption. The short term observation failed to take into account subtle, long-term effects which were not predictable at that time. By 1971-1972, much more information will be available to determine the success of shad emmigrating past the Connecticut Yankee effluent, but presently, the harm is outweighed by the benefits. Forty-five references are included. (Osborne-Vanderbilt)
W70-09611

THERMAL EFFECTS AND NUCLEAR POWER STATIONS IN THE U.S.A.,
Atomic Energy Commission, Washington, D.C.
For primary bibliographic entry see Field 05B.
W70-09612

THERMAL EFFECTS STUDIES IN NEW YORK STATE,
Stoller (S. M.) Associates, New York; and Niagara Mohawk Power Corp., Buffalo, N.Y.
Thomas W. Philbin, and Howard D. Phillipp.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 12, 1970. Paper IAEA-SM-146/32. 13 p, 3 tab, 10 ref. Preprint.

Descriptors: *Power plants, *Thermal pollution, *Thermal stratification, Hydraulic models, Fish, Algae, Fathometers, Benthic fauna, Benthic flora, Lake Ontario, Hudson River, Standards, Surface waters, Epilimnion, Intake structures, Discharge (Water), Water temperature.
Identifiers: Lake Cayuga, Cladophora, Ecological studies.

Several thermal effects studies have been and are presently underway to determine what the effects of thermal discharges are on the water environment of New York State. At present, the results are incomplete; but they do yield enough information to allow some initial conclusions. On Lake Ontario, the Ginna and Nine Mile Point studies showed that fish tended to gather around both intake and discharge structures, slightly altering the local fish and benthic distributions. On Lake Cayuga, the Bell Nuclear Station has been postponed with no immediate plans for resumption. Physical effects studies on the lake, if the Bell Station plant were operating, have yielded a probable 0.7 degree F rise in the average surface temperature along with an eight to ten day longer stratification period. Moreover, in October, water could possibly be drawn from the epilimnion, increasing discharged water another 5 degree F. However, if New York State discharge standards are adhered to, no acute effects are anticipated even close to the outfall. On the Hudson River, on the other hand, increased water temperatures as high as 91 degree F do not appear to influence the abundance of fish. (Osborne-Vanderbilt)
W70-09614

THE RELATIVE SIGNIFICANCE OF PHOSPHORUS AND NITROGEN AS ALGAL NUTRIENTS,
North Carolina Water Resources Research Inst., Raleigh.
Charles M. Weiss.
Available from the NTIS as PB-194 054, $3.00 in paper copy, $0.65 in microfiche. Report No. 34, Water Resources Research Institute of The University of North Carolina, June 1970. 54 p, 27 fig, 8 ref, 2 append. OWRR Project B-003-NC (2).

Descriptors: Eutrophication, *Algal blooms, *Nutrients, *Phosphorus, *Nitrogen, *North Carolina.
Identifiers: Nutrient interchange, Haw River, New Hope River.

By the examination of the interaction between nitrogen and phosphorus species relative to algal growth in several fresh water environments of differing trophic state, it has been possible to establish the relative significance of these elements as algal nutrients. The algal assay was carried out using membrane filtered samples derived from a series of oxidation ponds receiving secondary effluent from a trickling filter plant and from samples derived from sampling points on the New Hope and Haw Rivers. The latter represented a series of changing river qualities with particular respect to the oxidation states of nitrogen and phosphorus. The algal assay used pure cultures of five species; Euglena rostifera, Chlamydomonas reinhardtii, Pandorina morum, Scenedusmus quadricauda, and Chlorella ellipsoidea. Each of these species has been described as normally associated with polluted waters. The results of both chemical and biological assay examined through multiple regression analysis of the independent variable involved in the algal assay as well as a quadratic analysis of covariance of NH3-N, NO3N and PO4-P established the relative significance of the nitrogen and phosphorus species in water containing high concentrations of these elements, concentrations normally found in discharges from biological waste treatment plants and following dilution in receiving streams. Under these circumstances it has been shown that the quantity of nitrogen rather than that of phosphorus determines the biomass of algae that might be expected to grow. This response holds true for the several species of algal that were used. It would thus appear that the question of algal nutrients takes on a somewhat more formidable dimension due to the considerably greater difficulty in removing in significant amounts the nitrogen that is normally found in municipal waste waters.
W70-09669

VARABILITY OF WINTERKILL SURVIVAL IN FISHES,
Wisconsin Univ., Madison. Water Resources Center.
Ronald J. Berg, and John J. Magnuson.
Available from the NTIS as PB-194 031, $3.00 in paper copy, $0.65 in microfiche. Final Report, University of Wisconsin, Water Resources Center, 1970. 40 p, 4 tab, 2 fig, 25 ref, append. OWRR A-024-WISC (1).

Descriptors: *Dissolved oxygen, *Winterkilling, Yellow perch, Wisconsin.
Identifiers: Grassy Lake, Trout Lake.

Dissolved oxygen concentrations lethal to yellow perch from Grassy Lake, which has a history of winterkill, were compared with concentrations lethal to yellow perch from Trout Lake, which does not winterkill, to determine if yellow perch from

ssy Lake were more tolerant. Closed system pirometers (57kliter aquaria containing 24 liters vater with mineral oil) were used. Dissolved oxn was determined by the Alsterberg modificaof the Winkler method. Winter experiments en directly from both lakes and with yellow ch which were taken from both lakes and then limatized to aerated holding ponds. Mean oxn concentrations lethal to ten fish (8 to 32 g) en directly from Grassy Lake which were acclitized to aerated ponds were 0.15 mg and 0.35 /liter, respectively. Mean oxygen concentrations al to ten fish (12 to 16 g) taken directly from ut Lake, and twenty fish (10 to 83 g) from ut Lake which were acclimatized to aerated ds were 0.36 mg and 0.45 mg/liter respectively. ring the summer yellow perch from Grassy Lake e still more tolerant to low oxygen than those n Trout Lake. Mean oxygen concentrations al to twenty fish (8 to 38 g) from Grassy Lake, eighteen fish (9 to 22 g) from Trout Lake were 2 and 0.81 mg/liter, respectively.
0-09671

RCURY IN THE MARINE ENVIRONMENT,
ipps Institution of Oceanography, La Jolla, if.
primary bibliographic entry see Field 05A.
0-09677

IMETHYLAMINONAPHTHALENE-1-SULNIC ACID (DANS ACID) AS STANDARD R QUANTUM YIELD OF FLUORESCENCE,
orgia Univ., Athens. Dept. of Entomology.
ester M. Himel, and Richard T. Mayer.
alytical Chemistry, Vol 42, No 1, p 130-132, uary 1970. 3 p, 1 fig, 1 tab, 21 ref. NIH Grant 00207.

scriptors: *Insecticides, *Biochemistry, *Enes, *Inhibitors, *Tracers, Analytical hniques, Metabolism, Pigments, Spectphotometry, Spectroscopy, Fluorescence, Oric compounds, Insects, Animal physiology.
ntifiers: Fluorescence spectroscopy, Insect chemistry.

part of a study of the mechanism and mode of tion of biologically active molecules, an exte- e series of fluorescent probe molecules have en designed and synthesized. Fluorescent probes e defined as fluorescent molecules whose spec- l response (quantum yield and fluorescence exation and emission) vary as a function of the physical environment with which the probe is sociated. This paper is concerned with the suitaity of DANS Acid (1) as a quantum yield stanrd and also reports the quantum yield of p-N ethyl, N (5-dimethylaminonaphthalene-1-sulnamido) phenol (DMP) (2), a new fluorescent obe model compound. (See also W70-06754; 70-09682 and W70-09770) (Knapp-USGS)
70-09683

FFECTS OF DEICING SALTS ON WATER UALITY AND BIOTA-LITERATURE REVIEW ND RECOMMENDED RESEARCH,
rginia Polytechnic Inst., Blacksburg.
E. Hanes, L. W. Zelazny, and R. E. Blaser.
ational Cooperative Highway Research Program eport 91, 1970. 70 p, 5 append.

escriptors: *Deicers, *Highways, *Water pollun, *Sodium chloride, *Calcium chloride, Ruoff, Infiltration, Wells, Ponds, Lakes, Toxicity, cology, Path of pollutants, Water pollution urces.

he use of sodium chloride and calcium chloride to d in the removal of snow and ice from roadways as become an integral part of normal highway aintenance operations in areas of the country that xperience significant snowfall. This report was repared following a thorough review of literature ertaining to the effects of the deicing salts on adside vegetation, water quality, and animal life. In addition to a current state-of-the-knowledge review with regard to the extent of the problem, it contains suggestions for alleviation of some of the detrimental effects caused by use of the deicing chemicals and identification of research needs, particularly in the area of the influence of the salts on domestic and wildlife water supplies. The report will be useful to highway personnel with specific responsibilities for maintenance, roadside development, and drainage. In view of the increasing concern about pollution of the environment, many other highway engineers, administrators, planners, and contractors, plus persons outside of the highway field, may also find it of interest. (Woodard-USGS)
W70-09705

ENVIRONMENTAL POLLUTION FROM HIGHWAY DEICING COMPOUNDS,
Maine Univ., Orono. Dept. of Plant and Soil Sciences.
F. E. Hutchinson.
Journal of Soil and Water Conservation, Vol 25, No 4, p 144-146, July-August 1970. 3 p, 1 fig, 3 tab, 7 ref. OWRR Project A-007-ME.

Descriptors: *Water pollution effects, *Sodium chloride, *Highway icing, *Snow removal, *Maine, Deicers, Roads, Chemcontrol, Salts, Groundwater, Leaching, Saline soils, Saline water.
Identifiers: Highway ice removal.

During the period 1965-1969, a study was made to determine what environmental pollution, if any, resulted from the average annual application of 25 tons of sodium chloride to each mile of paved highway in Maine. Analyses of water samples indicated that wells and farm ponds were seriously contaminated with chloride ions. Soil sample analyses revealed that soils contiguous to highways contained sodium levels that threaten vegetation and soil drainage. Concentrations of these ions in rivers apparently were not influenced by this practice. (Knapp-USGS)
W70-09844

PRELIMINARY OBSERVATIONS OF THE HYDROMECHANICS, NUTRIENT CYCLES AND EUTROPHICATION STATUS OF LAKE KINNERET (LAKE TIBERIAS),
Limnological Lab., Tabigha (Israel).
For primary bibliographic entry see Field 02H.
W70-09889

NITROGEN DISTRIBUTION IN SOME WISCONSIN LAKE SEDIMENTS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 02H.
W70-09891

THERMAL REQUIREMENTS TO PROTECT AQUATIC LIFE IN TEXAS RESERVOIRS,
Texas Electric Service Co., Fort Worth.
For primary bibliographic entry see Field 02H.
W70-09893

EFFECT OF EUTROPHY AND DESALINATION ON THE PHYTOPLANKTONIC POPULATIONS, (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume; and Centre Universitaire de Luminy, Marseille (France). Laboratoire d'Hydrobiologie Marine.
For primary bibliographic entry see Field 02L.
W70-09897

SOME EFFECTS OF DETERGENTS IN THE MARINE ENVIRONMENT,
University of Strathclyde, Glasgow (Scotland). Dept. of Biology.
E. J. Perkins.
Chemistry and Industry, Vol 1, p 14-22, 1970. 5 fig, 10 tab, 4 ref.

Descriptors: *Detergents, *Sea water, *Environment, Mollusks, Crabs, Toxicity, Fisheries, Enzymes, Physicochemical properties, Hydrogen ion concentration, Salinity, Mortality, Animal behavior, Water pollution effects, Surfactants, Gastropods.
Identifiers: Nucella lapillus, Littorina saxatilis, Littorina littorea, Mytilis edulis, BP 1002, Dasic 'Slickgone', Petrofina 'Tarsolvent', Buccinum undatum, DS 4359, Carcinus maenas, Eupagurus, Psammechinus miliaris, Mucus secretion, Median tolerance limit, Delayed mortality, Oil emulsifiers.

Generally, detergents have considerable toxicity, ranging from -1 to more than 1000 ppm. During an evaluation of detergents' effects, the growth of shore-dwelling gastropod molluscs was studied because they could be easily and permanently marked, and could be released to and recovered readily from the shore. Littorina saxatilis, Littorina littorea, and Nucella lapillus were investigated for growth after treatment with a range of acute and apparently sub-lethal concentrations. Information on mortality and effects of predation upon treated animals was obtained. The effects of detergents on the closing of the operculum may be due to enzyme inhibition reactions, interaction between the detergents and other toxic substances present in seawater, or physico-chemical interactions between the detergents and seawater, and possibly the mucus secretion on the animal body. It is shown that the median tolerance limit derived from a short period recovery technique is a poor indicator of long term mortality due to dosage by detergents. Both mortality and inhibition of growth may be significant at very low concentrations, while inactivation may have more effect upon survival than mean tolerance limit. (Jones-Wisconsin)
W70-09899

MAN'S INFLUENCE ON LAKE ERIE,
Southern Illinois Univ., Carbondale. Dept. of Botany.
For primary bibliographic entry see Field 02H.
W70-09900

A SIMPLE, INEXPENSIVE ALGAL CHEMOSTAT,
North Carolina State Univ., Raleigh. Dept. of Zoology.
For primary bibliographic entry see Field 07B.
W70-09904

IMPLICATIONS OF MICROBIAL POLYMER SYNTHESIS IN WASTE TREATMENT AND LAKE EUTROPHICATION,
Ohio State Univ., Columbus.
For primary bibliographic entry see Field 05D.
W70-09936

THE CONDITION OF LAKES AND PONDS IN RELATION TO THE CARRYING OUT OF TREATMENT MEASURES,
P. J. Laurent, J. Garaucher, and P. Vivier.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 10 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Lakes, *Ponds, *Waste water treatment, *Sewage treatment, *Biology, *Nitrification, Dissolved oxygen, Water pollution, Thermal stratification, Depth, Microorganisms, Microbiology, Eutrophication.
Identifiers: Chemical compositions, Leman Lake, Annecy Lake, Nantua Lake.

Several aspects of the pollution and associated nitrification occuring in the three largest freshwater lakes in eastern France are presented. In addition the remedial measures being carried out or proposed are described. Data are presented on two of the lakes with respect to percentages of saturation of dissolved oxygen and temperature from 1937 to 1968. For one of the lakes the nitrates in the deep water have nearly doubled in ten years and the total phosphorus is increased from 15 to 25

micrograms/l for the whole lake. Biological studies were done through the collection of samples of net plankton. The counts of each main group of algae are tabulated and give additional information about the changes in the lakes. The measures taken against eutrification were provision of the towns with mechanical and biological treatment systems followed by the chemical removal of phosphorus. After a great technical and financial effort in 1968, the equivilant of 44% of the litoral population was connected to these stations. The sanitary improvement has also dealt with the treatment through composing of garbage; formerly a large part of the refuse was disposed in streams and carried into the lake during the flood period. One lake seems to have stopped its trends towards increasing nitrification. For another of the lakes despite the employment of mechanical and biological treatment unfavorable chemical and biological evolution has taken place. (Hancuff-Texas)
W70-09941

ACUTE TOXICITY OF TWO ORGANIC MERCURY COMPOUNDS TO THE TELEOST, ORYZIAS LATIPES, IN DIFFERENT STAGES OF DEVELOPMENT,
Toho Univ., Tokyo (Japan). Dept. of Biology.
Akio Akiyama.
Bulletin of the Japanese Society of Scientific Fisheries, Vol. 36, No. 6, 1970, p 563-570. 4 fig, 2 tab, 13 ref.

Descriptors: Bioassay, *Toxicity, Heavy metals, *Fish eggs, *Lethal limit, Fungicides, *Embryonic growth stage, Copper sulfate, Mode of action, Regression analysis, Resistance.
Identifiers: *Mercury, *Oryzias latipes, PMA, MEMC, Uspulum, *Mercuric chloride, *Phenylmercuric acetate, *Metoxygethylmercuric chloride.

The differential susceptibility of eggs, developing embryos, fry, and adult of a cypridont fish, Oryzias latipes, have been studied on the base of the 24-hour Median Tolerance Limit (TLm) to the organic mercury compounds, phenylmercuric acetate and metoxyethylmercuric chloride. Metoxyethylmercuric chloride was less toxic than phenylmercuric acetate. To metoxyethylmercuric chloride, 24-hour TLm for eggs, fry, and adult was 0.50-1.30, 1.48 and 1.74 ppm, respectively, while to phenylmercuric acetate, 0.18-0.26, 0.03, and 0.21 ppm, respectively. Adult fish were more tolerant than fry, but eggs in the solution of PMA were most resistant. In developing embryos, 24-hour TLm to the organic mercury compounds gradually increased through the early stage, passed through a maximum to the median phase, at 5 day old, and finally fell off in the later phase, in a general minimum. With the process of growth of fish, 24-hour TLm increased logarithmically. (Sjolseth-Washington)
W70-09970

TOXICITY EVALUATION OF A TECHNIQUE FOR INTRODUCING DIELDRIN INTO WATER,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 05A.
W70-09971

CONCENTRATIONS OF TRACE ELEMENTS IN GREAT LAKES FISHES,
Argonne National Lab., Ill.; and Bureau of Commercial Fisheries, Ann Arbor, Mich.
Henry F. Lucas, Jr., David N. Edgington, and Peter J. Colby
Journal Fisheries Research Board of Canada, Vol. 27: 677-684, 1970. 2 tab, 12 ref.

Descriptors: *Trace elements, Heavy metals, *Great Lakes, Lake Michigan, Lake Superior, Lake Erie, Toxicity, Fish toxins, Perches, Alewife, Cobalt, Chromium, Copper, Gold, Water pollution sources, Neutron activities analysis, Shiners.
Identifiers: Uranium, Thorium, Cadmium, Arsenic, Antimony, Lanthanum, Rhenium, Rubidium, Selenium, *Tissue analyses, Bromine, Fish livers.

The concentration of 15 trace elements was determined by activation analysis of samples of whole fish and fish livers from three of the Great Lakes; Michigan, Superior, and Erie. The average concentrations of 7 elements in 19 whole fish from 3 species were as follows: uranium, 3 ppb (parts per billion); thorium, 6 ppb; cobalt, 28 ppb; cadmium, 94 ppb; arsenic, 16 ppb; chromium, 1 ppm; and copper, 1.3 ppm. The average concentrations of 8 elements in 40 liver samples from 10 species of fish were as follows: uranium, approximately 2 ppb; thorium, less than or equal to 2 ppb; cobalt, 40 ppb; copper, 9 ppm; zinc, 30 ppm, bromine, 0.4 ppm; arsenic, 30 ppb; and cadmium, 0.4 ppm. Other elements observed in most of the samples were: antimony, 5-100 ppb; gold, 2-5 ppb; lanthanum, 1-20 ppb; rhenium, 0.5-5 ppb; rubidium, 0.06-4 ppm; and selenium, 0.1-2 ppb. Trace element concentrations varied with species and lake. Uranium and thorium varied with species, but not for the same species from different lakes. The levels of copper, cobalt, zinc, and bromine varied little between species and lakes. The concentration of cadmium, arsenic, and chromium varied between species and with species between lakes. (Sjolseth-Washington)
W70-09972

INFLUENCE OF PENTACHLOROPHENOL ON FATTY ACIDS OF COHO SALMON (ONCORHYNCHUS KISUTCH),
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
D. Hanes, H. Krueger, I. Tinsley, and C. Bond.
Proceedings of the Western Pharmacological Society II, p 121-125, 1968. 2 fig, 2 tab, 3 ref. PHS Grants 1T1 GM 1192 and EF 105.

Descriptors: Animal metabolism, *Fish physiology, *Biochemistry, Water pollution effects, *Lipids, Toxicity, Growth rates, Length, Mode of action, Fish diets, Laboratory tests.
Identifiers: Coho salmon, *Pentachlorophenol, *Fatty acids, Catabolism, Fatty acide methyl esters, Metabolic rate.

Control salmon catabolized 25% of their available fatty acids (mass in diet plus mass in Day 0 salmon) over a 14-day period compared to 47% in KPCP poisoned salmon. Individual fatty acids showed a tendency to be either lost or conserved due to their different rates of net catabolism. The tendency of each acid to be lost or conserved was the same in both untreated and KPCP (potassium pentochlorophenal) poisoned salmon. The excess net catabolism of each fatty acid in salmon under KPCP poisoning was directly proportional to the available mass of that fatty acid. (Sjolseth-Washington)
W70-09973

INFLUENCE OF OXYGEN CONCENTRATION ON THE GROWTH OF JUVENILE COHO SALMON,
Oregon State Univ., Corvallis. Dept. of Fish and Game Management.
Robert B. Herrmann, Charles E. Warren, and Peter Doudoroff.
Transactions American Fisheries Society, Vol. 91, No. 2, 1962, p 155-167. 3 fig, 2 tab, 15 ref. PHS Grant RG 4352.

Descriptors: *Oxygen requirements, Dissolved oxygen, Mode of action, Water temperature, Laboratory tests, *Growth rates, Mortality, Animal metabolism, Water pollution effects, Fish physiology, Fish management, *Bioassay, Lethal limit, Fish-kill, *Fish behavior.
Identifiers: *Coho salmon, *Food consumption rates, *Food conversion rates.

Juvenile coho salmon were held at 20 deg C. in 12-gallon bottles, usually 10 to a bottle, in continuously renewed fresh water having various dissolved oxygen concentrations. In most of the experiments, the fish were fed beach hoppers to repletion twice daily so that food was available for 10 hours each day. Growth and food consumption rates of age-class 0 juveniles observed in the year 1956 declined slightly with reduction of oxygen concentration from a mean of about 8.3 to 6 and 5 mg/l, and declined more sharply with further reduction of oxygen concentration. Food conversion ratios were slightly depressed at concentrations near 4 mg/l, and were markedly reduced at lower concentrations. At concentrations averaging 2.1 to 2.3 mg/l, many fish died and surviving fish consumed very little food and lost weight. Interesting seasonal variations were noted of the dissolved oxygen requirements of coho salmon, their food and oxygen consumption rates, and their gross food conversion efficiencies. The conversion efficiencies apparently increased, whereas food consumption rates declined in the fall of 1956. The seasonal variations are not ascribable entirely to size differences. (Katz-Washington)
W70-09974

THE INFLUENCE OF OXYGEN CONCENTRATION ON THE SWIMMING PERFORMANCE OF JUVENILE PACIFIC SALMON AT VARIOUS TEMPERATURES,
Oregon State Univ., Corvallis. Dept. of Fish and Game Management.
Gerald E. Davis, Jack Foster, Charles E. Warren, and Peter Doudoroff.
Transactions American Fisheries Society, Vol. 92, No. 2, 1963, p 111-124. 5 fig, 2 tab, 18 ref. PHS Grant RG 4352.

Descriptors: *Chinook salmon, *Oxygen requirements, Dissolved oxygen, Laboratory tests, *Fish physiology, Fish behavior, Swimming, Water temperature, Oxygenation, Laboratory equipment, Animal metabolism, Water pollution effects, Thermal stress, Performance.
Identifiers: *Coho salmon, *Swimming performance, Hemoglobin content.

The sustained swimming speeds of juvenile coho and chinook salmon tested in a tubular chamber at temperatures ranging from 10 to 20 deg C. usually were dependent on the disolved oxygen concentration at any tried concentration below the air-saturation level. Reduction of oxygen concentration from air saturation levels to 7,6,5,4 and 3 mg/l usually resulted in reduction of the maximum sustained swimming speed of coho salmon by about 5, 8, 13, 20 and 30 percent, respectively. These percentages are based on the observed performance of the first-failing and second-failing individuals of a group of five fish used in a performance test. The corresponding estimated percent reductions of the swimming speed of first-failing fish in most of the early exploratory experiments with chinook salmon were somewhat greater, averaging approximately 10, 14, 20, 27, and 38 percent, respectively. Within the ranges of tested concentrations above the saturation levels, variations of oxygen concentration had little or no effect on the performance of wild underyearling and hatchery-reared yearling coho salmon. The performance of the wild underyearlings at tested oxygen concentrations improved progressively with increase of temperature from 10 to 15 and to 20 deg C. (Sjolseth-Washington)
W70-09975

RECOVERY OF A SALT MARSH IN PEMBROKESHIRE, SOUTH-WEST WALES, FROM POLLUTION BY CRUDE OIL,
K. J. M. Baker, and E. B. Cowell.
Biological Conservation, Vol. 1, No. 4, July 1969, p 291-295. 2 fig, 2 tab, 8 ref.

Descriptors: Resistance, Water pollution effects, *Salt marshes, Oily water, *Oil, *Marine algae, Water pollution sources, On-site data collections, *On-site investigations, Frequency, *Frequency analysis.
Identifiers: *Recovery, Oil spill, *Oil pollution, *Filamentous green algae, Halimone portulacoides, Suaeda maritima, Aster tripolium, Pembroke, South-west Wales.

entlass Salt Marsh, near Pembroke, south-west Vales, was polluted by Kuwait crude oil in January 967. Frequency data taken in June 1966, June 967, and June 1968, show that some species were ore affected than others by the oil. In June 1967, uaeda maritima, Salicornia spp., Halimione portu-coides, and filamentous green Algae, showed the eatest reduction of frequency, while Aster tripoli-n, Cochlearia spp., Triglochin maritima, Puc-nellia maritima, Juncus gerardi, Limonium hu-ile, and Spartina townsendii showed some reduc-on. At the time frequencies of Festuca rubra, Pan-go maritima, Armeria maritima, Artemisia aritima, Glaux maritima, and Spergularia spp., ere not significantly lower than the pre-spill vels. By June 1968 most of the species which ere affected in 1967 showed some recovery, the ception being Triglochin maritima, the ill-effect which had increased. The species with the eatest coverage, Festuca rubra in the upper arsh, Puccinellia maritima in the mid-marsh, and artina townsendii in the lower marsh, had all covered more or less completely by June 1968. jolseth-Washington)
70-09976

SSOLVED OXYGEN REQUIREMENTS OF EVELOPING STEELHEAD TROUT AND HINOOK SALMON EMBRYOS AT DIF-ERENT WATER VOLOCITIES,
egon State Univ., Corvallis. Dept. of Fisheries d Wildlife.
uart J. Silver, Charles E. Warren, and Peter udoroff.
ansactions American Fisheries Society, Vol. 92, . 4, 1963, p 327-343. 7 fig, 7 tab, 11 ref. PHS ant RG 4352.

escriptors: Fish physiology, Growth rates, Dis-lved oxygen, *Oxygen requirements, *Chinnok lmon, Laboratory tests, *Embryonic growth ge, Fish eggs, Environmental effects, *Hatching, iability, *Mortality, Length, Weight, Fish roduction, Laboratory equipment, Spawning, tching success.
entifiers: *Steelhead trout, *Water velocity, ize differences, Hatching size, Spawning success, tching time, Hatching success.

nbryos of steelhead trout and chinook salmon, re reared from fertilization of the eggs to tching at different constant oxygen concentra-ns and water velocities. Measurements of the nbryos and hatched fry indicate that water veloci-s must be high enough not only to transport ough oxygen to the redd for supplying the total quirement of all embryos, but also to deliver suf-ient oxygen to the surface of the chorion en-loping the individual embryo. Steelhead embryos ld at 9.5 deg C. and chinook salmon embryos ld at 11 deg C. all died at an oxygen concentra-n of 1.6 mg/l. Survival of large percentages of bryos reared at concentration as low as 2.5 mg/l s apparently made possible by reduction of piration rates and consequent reduction of owth and development rates. Sac fry from emb-s reared at low and intermediate oxygen con-ntrations were smaller and weaker than sac fry m embryos reared at high concentrations. The e of steelhead trout and chinook salmon fry at tching probably was dependent on water velocity en at velocities as high as 740 and 1,350 cm/hr, pectively, and on oxygen concentration even at ncentrations near saturation levels. (Sjolseth-shington)
70-09977

RGANOCHLORINE INSECTICIDES IN RAIN-OW TROUT FROM THREE NORTH ISLAND KES,
partment of Agriculture, Wellington (New Zea-d). Wallaceville Animal Research Center.
R. B. Solly, and Valerie Shanks.
w Zealand Journal of Marine and Freshwater search, Vol. 3, No. 4, December 1969, p 585-0. 4 tab, 8 ref.

Descriptors: *Pesticide residues, Rainbow trout, Gas chromatography, *DDT, Chlorinated hydrocarbon pesticides, *Heptachlor, *Dieldrin, Water pollution effects, On-site data collections, Surveys, Analytical techniques.
Identifiers: *DDD, *DDE, *New Zealand, *Lindane, *Heptachlor epoxide, Rotorua.

From 12 rainbow trout (Salmo gairdneri Richardson) taken from each of three lakes, (Rerewhakaaitu, Opouri and Okataina) in the Rotorua district, N. Z., samples of liver, skeletal muscle and, from mature fish, the gonards were examined for organochlorine insecticides. Lindane, Heptachlor and heptachlor epoxide were not detected in any of the samples. Traces of dieldrin were detected only in trout taken from Rerewhakaaitu Lake. In all fish examined, pp'-DDT, pp'-DDD and pp'-DDE were detected all three tissues. The highest concentrations were found in some of the ovaries of fish from Rerewhakaaitu Lake, the catchment area of which had been extensively topdressed with DDT. Although most of the catchment area of Lake Okataina had never been topdressed with DDT, fish from this lake contained small amounts of DDT and its metabolites. (Sjolseth-Washington)
W70-09978

5D. Waste Treatment Processes

COMBINED SEWER OVERFLOW ABATEMENT TECHNOLOGY.
Federal Water Quality Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-09558

WATER TEMPERATURE CONTROL WEIR FOR MERAMEC PARK DAM, MERAMEC RIVER, MISSOURI,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Joseph P. Bohan.
U.S. Army Engineer Waterways Experiment Station, Technical Report H-70-1, Feb. 1970. 32 p, 4 fig, 6 photo, 7 plates.

Descriptors: *Temperature control, *Stratified Flow, Hydraulic models, Thermocline, Water temperature, Weirs, Control Equipment, Water quality control, Withdrawal.
Identifiers: *Meramec Park Dam.

Tests were conducted on a 1:40-scale model of the water temperature control weir for the Meramec Park Dam to investigate the discharge characteristics of the weir and determine its effectiveness in preventing the release of cold water from the hypolimnion. The model consisted of a section of the approach channel, the control weir, and the intake structure. Density stratification caused by temperature differentials in the prototype was simulated in the model by using saline and fresh waters. The weir was found to be effective for containing the cold water during release of desired rates of flow of 131 to 1028 cfs from the water supply and water-quality control (joint use) pool (el 608.0 to 675.0). Some withdrawal of cold water (approximately 7 percent) was observed with a discharge of 8000 cfs and a pool elevation of 680.0. The results of this study and similar tests on the Clarence Cannon and West Point water temperature control weirs were used to develop a preliminary, generalized technique for predicting the effectiveness of submerged weirs. (Hsieh-Vanderbilt)
W70-09602

PLUME EFFECTS OF NATURAL DRAFT HYPERBOLIC COOLING TOWERS,
Gilbert Associates, Inc., Reading, Pa.; and Metropolitan Edison Co., Reading, Pa.
For primary bibliographic entry see Field 05C.
W70-09604

ROTARY VIBRATORY FINE SCREENING OF COMBINED SEWER OVERFLOWS,
Cornell, Howland, Hayes and Merryfield, Portland, Oreg.
Donald M. Marshe.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows', p 57-106, June 22-23, 1970. 13 figs, 6 tab, 2 ref. FWQA Contract 14-12-128.

Descriptors: *Primary treatment, *Storm flow, Sewers, Overflow, Sewage treatment, Estimated cost.
Identifiers: *Screening, Combined sewer systems.

This study sought to determine the feasibility, effectiveness, and economics of employing high-rate, line-mesh screening for primary treatment of storm water overflow from combined sewer systems. The final form of the screening unit stands 63 inches high and has an outside diameter of 80 inches. The unit is fed by an 8-inch pipe carrying 1700 gpm (122 gal/min/ft sq) which is distributed to a 60-inch diameter rotating (60 rpm) stainless steel colar screen having 14 square feet of available screen area and a 165 mesh (105 micron opening, 47.1 percent open area). The screen is back-washed at the rate of 0.235 gallons of backwash water per 1000 gallons of applied sewage. Based on final performance tests run on dry-weather sewage, the unit is capable of 99 percent removal of floatable and settleable solids, 34 percent removal of total suspended solids and 27 percent removal of COD. The screened effluent is typically 92 percent of the influent flow. On the basis of a scale-up design of a 25 mgd screening facility, the estimated cost of treatment is 22 cents/1000 gallons. No finite cost comparisons were made with other treatment methods; however, when compared to conventional primary sedimentation, the selection of a screening facility as a treatment method is dependent on the value and availability of land, the design capacity of the treatment facility, the character of rainfall and runoff, and the means of disinfection. It was observed that the proposed screening facility required 1/10 to 1/20 the land required by a conventional primary treatment plant. (See also W70-09558). (Marriott-Chicago)
W70-09616

ASSESSMENT OF COMBINED SEWER PROBLEMS,
American Public Works Association, Chicago, Ill.
Richard H. Sullivan.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows', p 107-121, June 22-23, 1970. 8 fig.

Descriptors: *Storm drains, *Sewers, *Overflow, *Regulation, Regulated flow, Water pollution, Water pollution control, Water pollution treatment, Infiltration, Water quality, Maintenance, Hydrology.
Identifiers: Combined sewers, Regulators.

Problems of combined sewers are discussed generally and specific attention is given to problems of the combined sewer regulator and the capacity of the treatment plant. A recently conducted study of combined sewer system overflow regulator facilities and practices covering design, application, construction, control and operation and maintenance procedures, is detailed. The specific purpose of this project was to analyze and evaluate the effectiveness of practices and to establish long-needed guidelines for more efficient and dependable control of overflows and for reduction in the frequency and duration of combined sewer flows and the resultant pollution in waters receiving such spills. The function of a regulator is to regulate or control the amount of the flow which is allowed to enter the interceptor system and to divert the balance to holding or treatment facilities, or to discharge this balance to a point of disposal in nearby receiving waters. The study of combined

sewer regulators involved interviewing a group of jurisdictions and then in cooperation with a panel of consulting engineers preparing a report and a manual of practice. Of the seventeen jurisdictions only three were found to operate regulators designed to minimize pollution by assuring that the interceptor sewer is fully charged. These were in Seattle, Minneapolis-St. Paul, and Detroit. Some of the major findings and recommendations of the study call for a reduction in the number of overflows, total systems management of the combined sewer system, use of dynamic type regulators to allow response to hydraulic conditions in the sewers, use of regulators that improve the quality as well as the control of its quantity and the need for improved maintenance and design of regulator facilities. Infiltration control is also discussed briefly. (See also W70-09558). (Marriott-Chicago)
W70-09617

THE USE OF SCREENING/DISSOLVED-AIR FLOTATION FOR TREATING COMBINED SEWER OVERFLOWS,
Rex Chainbelt, Inc., Milwaukee, Wis.
Donald G. Mason.
In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 123-138, June 22-23, 1970. 9 fig, 4 ref. FWQA Contract 14-12-40.

Descriptors: Water pollution treatment, Flotation, Flocculation, Storm drains, Overflow, Urbanization.
Identifiers: Screening/flotation system, Milwaukee, Wisconsin.

The treatment of combined sewer overflow by screening and dissolved-air flotation was studied. The objectives were to determine the effectiveness and cost of a screening/flotation system. A combined sewer (Hawley Road) in Milwaukee, Wisconsin was monitored and laboratory testing which included screening, chemical oxidation, and dissolved-air flotation was performed. The results of the tests indicated a combination of screening flotation provided a feasible system and a prototype demonstration unit with a 5 mgd capacity was designed and installed. The system has been operated on 30 overflows. Removals of BOD, COD, SS, and VSS have been in the range of 50-75%. The waste solids stream has averaged only about one per cent by volume of the raw feed water. Operation has been very satisfactory with a minimum of maintenance required. Chemical flocculants have been utilized to increase the removal efficiencies to the upper values of the above range. Cost estimates have been made and these indicate a total installed cost of $12,000 per mgd capacity. Operating costs are estimated at 1.0cents/1000 gallons without chemical flocculant addition. Chemical costs should be in the range of 2.0-2.5cents/1000 gallons. Based on the results of this study screening/flotation offers an alternate to sewer separation in some areas. The project is scheduled for completion in early summer 1970. (See also W70-09558). (Marriott-Chicago)
W70-09618

UNDERFLOW PLAN FOR POLLUTION AND FLOOD CONTROL IN THE CHICAGO METROPOLITAN AREA.
Metropolitan Sanitary District of Greater Chicago, Ill Dept of Public Works and Buildings.

In Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 139-218, June 22-23, 1970. 20 fig, 9 tab, 8 ref.

Descriptors: *Underground storage, *Underflow, Sewers, Water pollution control, Flood control, Water storage, Storm runoff, Underground structures, Construction, Tunnels, Permeability, Dolomite, Limestone, Tunneling machines.
Identifiers: Underflow-storage Plan, Deep Tunnel Plan, Chicago Drainage Plan, Chicagoland area.

To solve the problems of flooding and water pollution in the Chicagoland area, a number of plans have been proposed and studied. Three of these plans, the Underflow-Storage Plan, the Deep Tunnel Plan and the Chicago Drainage Plan, are still viable alternates for the total solution to meet the water quality standards established by the state and Federal Governments and the requirements of handling the runoff from a 100-year storm. During the study of the Underflow-Storage Plan, it was decided to modify a large relief sewer proposed by the City of Chicago, as an Underflow Sewer similar to the metropolitan area-wide plan but on a much smaller scale. The Underflow Sewer would be constructed in solid rock, 250 feet below the ground surface. This sewer as well as two additional Underflow Sewers are under construction by the Metropolitan Sanitary District at widely separated locations in the Chicago area in the same dolomitic limestone rock formation. Construction of these sewers has confirmed the structural integrity and dense impermeability of this underlying rock blanket throughout the entire Chicago area. Further evaluation of the three plans indicates that portions of the Underflow-Storage Plan designated for the First Phase construction are compatible with further extensions along the general conceptual lines of any of the three plans. It is recommended that the final design of the First Phase work proceed and that all alternates for the Second Phase be thoroughly and systematically studied concurrently to determine the final plan. (See also W70-09558). (Marriott-Chicago)
W70-09619

SURVEY OF WATER UTILIZATION AND WASTE CONTROL PRACTICES IN THE SOUTHERN PULP AND PAPER INDUSTRY,
North Carolina Water Resources Research Inst., Raleigh.
Peder J. Kleppe, and Charles N. Rogers.
Available from the NTIS as PB-194 053, $3.00 in paper copy, $0.65 in microfiche. Report No. 35, Water Resources Research Institute of the University of North Carolina, June 1970. 77 p, 11 tab, 5 fig, 3 ref, 3 append. OWRR Project A-036-NC (1).

Descriptors: Pulp and paper industry, *Pulp wastes, *Industrial wastes, Water pollution sources, Water use industrial, *Water utilization, *Industrial plants.

The state of water usage and water pollution abatement in the Southern Pulp and Paper Industry was studied by surveying forty-six mills which produce about 60% of the total pulp and paper output of this region. The study covered use and treatment of fresh water, reuse of water in the mills, the amount of waste water and pollutants, waste treatments, and sludge disposal. The amount of waste water from the surveyed mills amounted to about 1,200 million gallons per day containing about 2.5 million pounds of BOD which was reduced to about 1.3 million pounds after treatment. Six areas of research are recommended: (1) Optimization of waste management; (2) Optimum reuse of process water; (3) Development of economical and non-polluting pulping and bleaching processes; (4) Obtaining completely closed water systems in pulp and paper mills; (5) Improvement of the present primary, secondary, and tertiary waste treatment processes, and the utilization of the products from these processes; and (6) Developing nonpollutant and economically feasible recovery processes for fibers from waste paper and board.
W70-09668

RAPID-FLOW FILTER FOR SEWER OVERFLOWS.
Rand Development Corp., Cleveland, Ohio.
For primary bibliographic entry see Field 05G.
W70-09741

PHILADELPHIA'S PLANS TOWARD INSTRUMENTATION AND AUTOMATION OF THE WASTE WATER TREATMENT PROCESSES,
Philadelphia Water Dept., Pa.
C. F. Guarino, and G. W. Carpenter.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 11 p, 4 fig, 1 tab, 8 ref.

Descriptors: *Waste water treatment, *Sewage treatment, *Instrumentation, *Automation, *Programs, Mathematical model, Computers, Information retrieval, Data processing.
Identifiers: *Philadelphia, Pennsylvania, *Flow diagram.

For the past several years, the City of Philadelphia has been working towards the instrumentation and automation of the Northeast Water Pollution Control Plant. The plant is designed to treat 175 MGD with a combined average suspended solids and biochemical oxygen demand removal of approximately 75%. The data logging program named 'Nelog', which has been in use since January 1967, reduces the time required for record keeping, minimizes human errors, and enables analysis of data which would be impractical if attempted manually. The computer generates a monthly operational report as well as a monthly summary and an annual report. The Nelog program evaluates the data and produces an output listing any deviation from that which is considered normal or acceptable. This report is brief and enables the technical personnel to review and/or reject questionable data. The Philadelphia Water Department conceived a master plan for the automation of the Northeast Water Pollution Control Plant entitled 'NE-PAT', Northeast Plant Automated Treatment. The initial phase includes all the necessary steps leading to a digital computer system installed on line at a secondary waste water treatment plant. Data that will be collected by the system shall include dissolved oxygen, total suspended solids, turbidity, BOD, TOC, COD, sludge volume index, nutrients (N and P both Total and Ortho) CO2, CH4, total dissolved solids (effluent) and settleability of sludges. (Hancuff-Texas)
W70-09742

EXTENDABLE SEWAGE PLANT IN PACKAGE TYPE CONSTRUCTION FOR RAPIDLY EXPANDING COMMUNITIES UP TO 25,000 INHABITANTS,
Technische Hochschule, Aachen (West Germany). Institut fuer Siedlungswasserwirtschaft.
B. Boehnke.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 7 p, 6 fig.

Descriptors: *Sewage treatment, *Waste water treatment, Organic loadings, *Activated sludge, Stabilization.
Identifiers: *Package plants.

The problems of waste water disposal in small and medium sized communities requires reliable sewage plants which could be easily overloaded in the case of quickly or rapidly growing communities. It must be possible to hold within safe limits the disturbance to a waste water purification plant in agricultural drainage areas caused by liquid manure, farm wastes and other waste water shock. The technique described incorporates a ten fold increase in flow quantity in the case of rain and a five fold overload of the biological stage. For a quick improvement of many overloaded plants a typical development is shown which permits rapid design work and examination by the official local control bodies. The use of flat foundation ducts for the buildings permits the employment of local contractors and saves expense in excavation. Separation of the drive sets for sewage circulation and oxygen supply provides favorable energy economic ratios. The coupling of the oxygen supply with sludge return from the secondary clarification to the aeration basin also favors an economical use of energy. Building cost evaluations show a basic type treat-

ient for 1,000 to 5,000 inhabitants can be built at fairly reasonable expense. Further expansions up o 25,000 show expenditures which lie in the cost ange of ordinary compact sewage treatment lants. (Hancuff-Texas)
W70-09744

IRUS REMOVAL IN WASTE WATER ENOVATION BY CHEMICAL COAGULATION AND FLOCCULATION,
linois Univ., Urbana.
. Chaudhuri, and R. S. Engelbrecht.
ifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. reprint, 21 p, 10 fig, 7 tab, 56 ref.

escriptors: *Viruses, *Coagulation, *Flocculation, *Waste water treatment, Chemical precipitation, Colloids, Sewage treatment, Aluminum, Adsorption, Bacteriophage.
dentifiers: Waste water renovation, T 4 viruses, f1S2 viruses.

Viruses are colloidal particles and in domestic aste water many of them are of public health significance. Clarification by floc formation (coagulation of flocculation) and filtration removes a large raction of viruses from waste waters. Although ata on removal of viruses by coagulation flocculation are available, little attention has been given to he basic mechanism involved. Removal of viruses y chemical coagulation flocculation with alluminum sulphate comprises a primary instantaneous nert reaction between virus coat protein and aluminum which results possibly in the formation of oordination complexes between aluminum and he carboxyl group of the virus coat protein. This is ollowed by incorporation into the precipitating ydrated aluminum oxide species and subsequent locculation and sedimentation. The process of hemical coagulation flocculation cannot be exected to operate with high virus removal efficiency in waste water renovation, as compared to water reatment because of the presence of organic natter in waste water effluent. Virus particles emoved in the settled floc are not inactivated but emain active. Therefore proper care should be aken in the disposal of sludge from coagulation locculation operations in waste water renovation. (Hancuff-Texas)
W70-09745

ECHNOLOGY OF PLASTIC MEDIUM TRICKLING FILTERS,
Ruhrverband, Essen (West Germany).
. Rincke, and N. Wolters.
ifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. reprint, 9 p, 7 fig, 1 tab, 17 ref.

Descriptors: *Plastics, *Trickling filters, *Technology, Hydraulics, Biological treatment, Phosphorus, Films, Microorganisms, Microbiology, Waste water treatment.

Several influences and variables of the tricking ilter are discussed from an elementary point of iew. In preliminary studies filling materials with 225 to 270 m sq/m cu specific surface showed etter performance than those with 90 to 160 m q/m cu. At arising BOD load the amount of emoval substrate increases but not proportionally. At a constant loading the hydraulic feeds in principle can exert several influences on the removal: (1) a change in water quantity results in the reciprocal change of the substrate concentration, (2) the decrease of hydraulic feed can have the effect that at below a certain value the total wetting of the biological film is no longer achieved. A test program was carried out in which organic loading and hydraulic feed were varied independently of each other over wide ranges. Investigations at a constant feed 13.2 cubic meters per meter hour showed a continuous increase of removal with higher surface loading. However a maximum removal was not achieved under these test conditions. At a constant organic loading there were only slight differences in the removal of organics depending on the hydraulic feed rate. At constant organic loading there was no distinct relationship shown between the influent concentration and removal. Decreased efficiency of BOD removal was also shown when phosphorus was lacking. (Hancuff-Texas)
W70-09746

A MATHEMATICAL MODEL FOR CONTACT STABILIZATION-MODIFICATION OF THE ACTIVATED SLUDGE PROCESS,
Toronto Univ., (Ontario).
P. H. Jones.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 7 p, 4 fig, 4 ref.

Descriptors: *Mathematical model, *Activated sludge, *Sewage treatment, Waste water treatment, Absorption, Hydrolysis, Computer programs.
Identifiers: *Contact stabilization, Laboratory studies.

The contact stabilization modification involves the mixing of a well conditioned activated sludge with a fresh unsettled raw waste water for a brief period. During this period of contact the sludge removes organic and inorganic pollutants by several mechanisms. The major mechanisms involved are absorption, adsorption and simple physical entrapment. Removal is extremely rapid but the organic material is not stabilized in this reactor. The initial contact is therefore followed by a solid-liquid separation usually by settling and the sludge containing the unstable organics is then admitted to a sludge reaeration tank. It is hypothesized that the three removal mechanisms occur simultaneously and are described by various mathematical models. Adsorption and physical entrapment are physical reactions and a function of: (1) the particulate material, (2) velocity gradient, (3) mixing operation and (4) concentration of solids in the form of floc. The reaction is assumed to obey a first order differential equation. Absorption is assumed to obey the same equation as the growth of microorganisms. Another equation is defined for the hydrolysis of the material. A computer program was written incorporating these variables and validated through the use of laboratory tests. A mathematical model was postulated and the calculated and observed curves matched quite closely. The complete computer program is presented. (Hancuff-Texas)
W70-09747

DYNAMIC PROGRAMMING FOR A SEWAGE TREATMENT SYSTEM,
Yachiyo Engineering Co., Tokyo, (Japan).
T. Futagami.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 12 p, 11 fig, 2 tab, 2 ref.

Descriptors: *Sewage treatment, *Dynamic programming, *Systems analysis, Mathematical models, Standards, Optimization, Water quality, Waste water treatment.
Identifiers: Flow chart, Grid method.

An optimal sewage system is studied by using dynamic programming. This dynamic programming is based on the principle of optimality and has the advantage of being able to handle the complicated planning problems. A mathematical model of river system is constructed for the application of dynamic programming. The concentration of the polluted material in the river and the treatment rate at each municipal waste water treatment plant are chosen as the state variable and the decision variable respectively. The objective function considered includes the construction cost and treatment cost at each waste water treatment plant and chemicals' costs for water supply. Taking account of the purification of river, the functional equations are derived for the application of dynamic programming. The recurrence formulae are derived to obtain the optimal planning. Finally, dynamic programming is applied to the Yodo River System by using the derived recurrence formulae and grid method. In this research the backward calculation procedure of dynamic programming is adopted. (Hancuff-Texas)
W70-09748

SECONDARY TREATMENT WITH GRANULAR ACTIVATED CARBON,
Calgon Corp., Pittsburgh, Pa.; and Willard F. Schade and Associates, Cleveland, Ohio.
J. L. Rizzo, and R. E. Schade.
Water and Sewage Works, Vol 116, No 8, August, p 307-312, 2 tab, 4 ref.

Descriptors: *Adsorption, *Activated sludge, *Activated carbon, *Biochemical oxygen demand, Tertiary treatment, Biological treatment, Isotherm, Sludge, Digestion, Phosphate, Waste water treatment.
Identifiers: *Suspended Solids, Polymers, Raw Sewage Contact Time, Backwaste.

A new waste water treatment process using granular activated carbon has been successfully tested. Based on the results of demonstration studies, low cost of construction and less land requirement are claimed to be the two primary advantages of this method over the conventional biological secondary treatment processes. The present method is an outgrowth of a need to expand the capacity of an established treatment plant. The aforementioned plan if adapted, will give more room for future expansion. Some of the works done by various other agencies in the application of activated carbon are also discussed. Results obtained from other demonstration projects are presented. The final design features of the granular activated carbon system are outlined and the various aspects which will be investigated during the first year of operation are enumerated. (Radhakrishnan-Texas)
W70-09749

OPTIMAL DEGREE OF SEWAGE WATER TREATMENT FOR EACH PROJECT OF THE COMPLEX,
State Water Conservation Inspection (USSR).
Y. P. Belichenko.
Fifth International Water Pollution Research Conference, San Francisco, July 26 - August 1, 1970. Preprint, 4 p, 2 fig, 1 tab.

Descriptors: *Sewage treatment, *Waste water treatment, *Optimization, *Efficiencies, Mathematical model, Water pollution, Cost.
Identifiers: Water uses, Purification.

Economic difficulties in solving the problem of conservation of water sources from pollution become especially evident if one takes into account the ever increasing quantities of sewage waters to be discharged in the future, and also the high construction costs of treatment works (averaging 100 roubles per cum. of wastes discharged per day), required to treat these increased discharges. Hence it follows how important it it to search for ways of decreasing construction and maintenance costs for decontamination of sewage waters. The relationship between construction costs of works for treating the sewage waters to different of purity is known. This relationship can be generally expressed as a function of initial and final concentrations of a pollutant and sewage discharge. After determining the required concentration of a certain matter contained in sewage effluents discharged into a water stream by each project on condition of providing the critical, admissable concentration of this matter at a downstream water use site with miminum expenses for construction of treatment works the required cost of each project can be evaluated through an optimization technique. (Hancuff-Texas)
W70-09750

A STUDY OF OPERATIONAL ANOMALIES IN DIGESTION TANKS,
Vattenbyggnadsbyran Ltd., Stockholm (Sweden).

N. Westberg, and B. Ericsson.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 9 p, 5 fig, 3 ref.

Descriptors: *Digestion, *Sludge treatment, *Digestion tanks, Circulation, Mathematical models, Waste water treatment, *Sewage treatment, Anaoerobic digestion.
Identifiers: *Digestion tanks, *Anomalies, Gas production, Gas removal.

Experimental runs have been carried out at the Jonkoping sewage plant, aimed at studying variation in the gas production cuased by intermittent feeding as well as intermittent pumping. At intermittent feeding the variations of the gas production during one day did not follow simple kinetic equations and showed two separate peaks, giving a picture of one primary and one secondary intensification of the gas production, thus indicating two successions of bacterial growth. On starting the circulation pump the gas production increased considerably and severe interference in the operation may arise, if the circulation rate is high enough. The intensity and durability of this increase depend upon the rate of circulation and the dimensions of the digester. Attempts have been made to develop mathematical formulae to describe the course of the variations. The calculated variations were greater than the experimental ones. Probably the deviations are primarily due to a very irregular flow pattern in the digester. The circulation flow seems to be concentrated in the central part of the digester. (Hancuff-Texas)
W70-09751

DEWATERING SEWAGE SLUDGE BY ELECTROOSMOSIS,
Rocketdyne, Canoga Park, Calif.
J. Greyson, and H. H. Rogers.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 14 p, 7 fig, 3 tab, 8 ref.

Descriptors: *Sludge, *Sludge treatment, *Sludge disposal, *Dewatering, *Electroosmosis, Costs.
Identifiers: Voltage, Power.

Electroosmotic pumping derives from the electrokinetic phenomenon of electroosmosis, i.e., the flow of water though porous matrices or constrained suspensions of fine particles that is associated with ion flow produced by an applied electric field. In contrast to conventional filtration, electroosmotic pumping is independent of the cross-sectional area of the pore structure of the filtering media and the inherent limitations of conventional filtration resulting from pore clogging or filter cake compression are removed. An investigation of electroosmotic pumping for dewatering sewage sludges to a solids level sufficient for autoincineration has been carried out, and it has been determined that the technique is applicable to sludges of various types. The most efficient dewatering is obtained when solids are collected from a screen cathode. For efficient dewatering from very wet sludge (2%) to burnable solids, it is necessary that an initial sludge film be formed at the cathode surface. Sludges cannot be thickened to a solids content exceeding 20% if the cake is beneath the liquid level of the sludge suspension; for drying beyond the 20% value, and cake must be brought out of the liquid. Preliminary cost estimates indicate that electroosmotic sludge dewatering is a potentially attractive unit process. (Hancuff-Texas)
W70-09752

HINDERED SETTLING AND THICKENING OF CHEMICALLY PRECIPITATED FLOCS,
Technical Coll. of Transport Engineering, Zillina (Czechoslovakia); and Hydraulic Research Inst., Brno (Czechoslovakia)
I. Tesarik, and J. Vostril
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 5 fig, 1 tab, 10 ref

Descriptors: *Settling velocity, *Chemical precipitation, *Flocculation, *Mathematical models, *Hydraulics, Turbulence, Fluids friction, Coagulation, Columns.

The problem of settling a layer of a concentrated suspension is rather important in water treatment but extremely difficult to solve. It is generally explained on the basis of Kynch's assumption. The flocs in the layer have various dimensions but, owing to the close packing, they sink at the same velocity. Kynch introduced the assumption that at any point in the dispersion the velocity of fall of a particle depends only on the local concentration of particles. Experiments with hindered settling were performed in a transparent column of internal diameter D=30 cm and total height h=250 cm. The experiments were performed with the chemical treatment of the raw water. Ferric chloride was the basic coagulant. The character of the suspended layer was varied by: (1) Changing the superficial velocity of fluidization (0.8 to 2.0 mm/sec). (2) Changing the water temperature. The Kynch equation u = a/ (M exp. alpha) was found to be applicable for suspensions of chemically precipitated flocs. It was concluded that the model tests of settling should be performed in a vessel of diameter 100 times greater than the floc dimension and the suspension height in the model and prototype should be equal. It was also concluded the relation between the velocity of settling and the total solids according to Kynch's theory is exponential; the exponent alpha is positive; its absolute value rises with the temperature and the coefficient a considerably increases with the content of suspended matters. (Hancuff-Texas)
W70-09753

ORGANIC AND LIQUID RETENTION TIME IN A TRICKLING FILTER FORMULATION,
West Pakistan Univ. of Engineering and Technology, Lahore (Pakistan).
M. I. Sheikh.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 8 p, 6 fig, 7 ref.

Descriptors: *Trickling filter, *Tracers, *Radioisotopes, *Sewage treatment, Formulation, Retention, Carbon radioisotopes, Depth, Filtration, Design, Pilot plants.
Identifiers: Glucose, Bromide 82.

In spite of its extensive use the design of filters has largely remained emperical and there is no commonly accepted theory of filter performance based on practical and theoretical grounds. Therefore fundamental research was made to study the influence of the many variables affecting the filter process. The investigations were divided into 2 phases: (1) liquid retention time studies on laboratory and pilot scale filters and (2) organic retention time studies on specially built experimental filters. Each pilot filter has an internal diameter of 6 feet and a total height of 11 feet and was operated at hydraulic loadings of 3570 and 140 gal/yd cu/day. The filter medium used was 2 inch stone with specific surface area of 23.8 ft sq/ft cu. The lab scale filters were 6 in. in diameter and 4 feet long, and were fed intermitantly at 5 minute intervals at the same loadings described above. They contained 3/4 inch and 1/4 inch sizes. The filter used for the organic retention time studies was an 18 inch diameter and a 6 foot depth reinforced concrete pipe; and was operated at a loading of 35 gal/yd cu/day. Br 82 was found to be the most suitable of the radio isotope tracers used for measurement of liquid retention time. Median time was found to be inversely proportional to the 0.87 power of the hydraulic surface loading and proportional to the filter depth and specific surface area of the filter medium. Up to 93% of the tracer carbon 14 was removed in about 30 minutes in the first foot of the filter. (Hancuff-Texas)
W70-09754

WASTE TREATMENT OPTIMIZATION BY GEOMETRIC PROGRAMMING,
California Univ., Irvine.
J. Scherfig, R. Schinzinger, and T. W. Morgan.
Fifth International Water Pollution Research Co
ference, San Francisco, July 26-August 1, 19
Preprint, 18 p, 17 ref.

Descriptors: *Sewage treatment, *Optimizatio
*Mathematical models, *Waste water treatme
Costs, Construction costs, Activated sludge, Slud
disposal, Aeration, Sedimentation.
Identifiers: *Geometric programming, Wet oxi
tion.

Geometric programming and two computer
gorithms for optimization of waste treatme
systems have been described. Mathematical mod
of waste treatment systems are classified as: (
Convex models; such models can be optimized
the convex problem algorithm. (2) Nonconv
models with few degrees of difficulty; these mod
can be optimized by the search algorithm. (3) No
convex models with many degrees of difficult
such models cannot be optimized by geometr
programming at the present time. A detailed mod
of a sludge treatment system including thickenin
aerobic digestion, wet oxidation, and ultima
disposal is presented and the optimum (i.e. lowe
annual cost) design of each unit determined for di
ferent constraints. The cost of computer time f
optimization is low (less than two minutes to
computer time) including compiling for the slud
treatment example and the algorithms are readi
adaptable to time sharing, thus geometric pr
gramming should become a very significant tool
routine engineering design. (Hancuff-Texas)
W70-09755

**THE pH TOLERANCE OF ANAEROBI
DIGESTION,**
New Mexico State Univ., Las Cruces.
R. H. Clark, and R. E. Speece.
Fifth International Water Pollution Research Cor
ference, San Francisco, July 26-August 1, 197
Preprint, 14 p, 10 fig, 3 tab, 27 ref.

Descriptors: *Hydrogen ion concentratio
*Digestion, *Anaerobic digestion, Toxicity
Methane, Fermentation, Acids, Sludge, Sludg
treatment, Sewage treatment, Waste water treat
ment, Chemical oxygen demand.

Eight laboratory anaerobic filters constructed fro
5.5 in. ID, 36 in. plexiglass columns filled with 1-
1/2 in. broken quartzite stone media were used t
study the effect of non-optimum pH on methan
fermentation. The reactor pH, methane produc
tion, and effluent Chemical Oxygen Demand
(COD) were the primary parameters measured
The pH levels between 3.9 and 9.3 were studied fo
durations of 12 hours to 21 days. Results showe
that: (1) Steady state acetate fermentation at pH
levels as low as 4 was possible, although at a rate
less than would be attained with the same reactor
and bacterial population in the optimum pH range
(2) Acetate fermentation in an anaerobic filter wa
not inhibited between pH 6 and 8. (3) The
recovery of acetate fermentation after a pH drop to
as low as 5.0 was complete and prompt if the drop
duration was less than 12 hours but required more
time than would be expected based on simple bac-
terial regeneration and was only pH dependent if
the drop duration exceeded 3 days. (4) A pH of 9
essentially stopped acetate fermentation, but
recovery was complete and prompt after optimum
pH levels were restored. (Hancuff-Texas)
W70-09756

SUBSTRATE FLOW IN ANAEROBIC DIGESTION,
National Inst. for Water Research, Pretoria (South
Africa).
D. F. Toerien, P. G. Thiel, and W. A. Pretorius.
Fifth International Water Pollution Research Con-
ference, San Francisco, July 26-August 1, 1970.
Preprint, 7 p, 7 fig, 19 ref.

Descriptors: *Digestion, *Anaerobic digestion,
*Anaerobic conditioning, *Sludge treatment,
*Flows, Waste water treatment, Sewage treatment,

Bacteria, Methane, Fermentation, Microorganisms.
Identifiers: Cells, Acetic acid.

The optimal utilization of anaerobic digestion is dependent on a knowledge of the mechanism of the process, since it forms the basis of kinetic evaluations of the process. Substrate flow in any biological treatment process depends on the organisms participating in the process, and proceeds at two levels namely, flow of substrate in single cells (intracellular substrate flow) and flow of substrate between cells (intercellular substrate flow). At least three different mechanisms might be involved in methanogenesis during anaerobic digestion. They are: (1) Single-step methanogenesis in which complex organics are decomposed directly to methane, (2) Dual-step methanogenesis in which intercellular substrate passes through the acid-forming and the methanogenic bacterial groups, and (3) Multi-step methanogenesis in which a symbiotic association of two bacterial species exists. The one attacks ethanol producing acetate and H2, while the other utilizes the H2 together with CO2, to produce CH4. It is concluded that if methanogenesis requires the activities of more than two groups of bacteria, another intermediate group of bacteria must exist in anaerobic digestion. The existence of such a group and its characteristics should be investigated. It is also concluded that although acetate is one of the major precursors of methane in anaerobic digestion, it is doubtful whether this reaction is 'growth-coupled'. This aspect should be investigated fully, since it is important in kinetic evaluations. (Hancuff-Texas)
W70-09757

KINETICS OF WASTEWATER CHLORINATION IN CONTINUOUS FLOW PROCESSES,
California Univ., Berkeley; and California State Health Dept.
R. E. Selleck, H. F. Collins, and G. White.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 11 p, 6 fig, 2 tab, 7 ref.

Descriptors: *Kinetics, *Chlorination, *Waste water treatment, *Sewage treatment, Flows, Mixing, Coliforms, Mathematical models, Ammonia, Tubes.
Identifiers: Tube reactor, Chlorine demand.

The effect of reactor mixing on the process performance of wastewater chlorination was studied in this investigation for the purpose of obtaining information which can be used to improve the performance of the process as well as to aid in its control. The significance of mixing in terms of process performance is illustrated. In one case an aqueous solution of gaseous chlorine was added to the head of a tubular reactor and in the second case directly to a completely backmixed tank reactor. The residence time in the tubular reactor was only 0.12 minutes while the mean residence time in the backmixed tank was 37.5 minutes. The overkill effected by the two methods of chlorination were radically different. The overkill was more than one order of magnitude greater than chlorine when applied to the tubular reactor. It is concluded from this study that the rate of kill appears to be independent of all factors except amperometric chlorine residual concentration and contact time (and possible temperature). It appears that some bactericidal action takes place as long as any detectable amperometric residual exists in the chlorinated waste water. The results also indicate that the bactericidal potential of the amperometric chlorine residual decreased with time. This indicated that the residual is composed of a number of different species of chlorine compounds which tend to cascade with time toward a less reactive species. (Hancuff-Texas)
W70-09758

KINETIC ASSESSMENT OF GLUCOSE REMOVAL AND SACCHARIDE ACCUMULATION CAPACITIES IN ACTIVATED SLUDGE,
Institute of Chemcial Technology, Prague (Czechoslovakia). Dept. of Water Technology.
M. Dohanyos, P. Grau, and J. Chudoba.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 5 fig, 12 ref.

Descriptors: *Activated sludge, *Kinetics, Sewage treatment , Waste water treatment, Enzymes, Microorganisms, Metabolism, Respiration.
Identifiers: *Glucose removal, *Saccharide accumulation, Sludge age.

Primary substrate removal capacity and primary saccharide accumulation capacity of activated sludge have been defined and their values assessed from glucose removal and cell saccharide build-up kinetic data. Dependence of both capacities on activated sludge age in a range from 1.25 to 30 days has been shown. The capacity ranged from about 20 to 400 ml of glucose (Or COD) per gram of initial activated sludge suspended solids depending on the sludge age and substrate composition. The glucose primary removal capacity (and also the accumulation capacity by analogy) depends also on the glucose proportion in the substrate on which the activated sludge is cultivated and on other components of a di-or, multi-substrate containing glucose as one component. As accompanying components glutamic acid and peptone were used in the study. One of the practical results of this study is a warning that synthetic sewage media based on glucose (and presumably even other saccharides) should not be used to obtain designed data unless this is justified by the actual composition of the waste. However it is felt that the relationships found in this study contribute toward understanding the basic characteristics of biological waste treatment. (Hancuff-Texas)
W70-09759

SURVEY OF SEWAGE UTILIZATION FOR AGRICULTURAL PURPOSES IN ISRAEL,
Israel Water Commission.
A. Feinmesser.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 4 tabs, 10 ref.

Descriptors: *Sewage treatment, *Agriculture, *Irrigation, Oxidation lagoons, Ponds, Oxidation, Crops, Water reuse, Water quality.
Identifiers: *Sewage disposal, Israel.

Discussion is presented on various means of sewage disposal for example: discharge to rivers and streams, discharge to sea, use for irrigation, disposal on dry river beds and treatment for reuse in urban areas. Results of a survey conducted in 267 settlements is tabulated and includes data on population, livestock and industry, quantities of waste sewered, quantities of water purified and the possibilities for reuse of sewage. The potential amount of reusable or usable sewage from the inspected settlements is 65,000 m cu/day. The amount being utilized was 42,000 m cu/day. A survey of urban sector was also conducted and covered 62 municipalities having a total population of 2,100,000. The sewage potential was 343,000 m cu/day. Of this amount about 84% or 287,000 m cu/day were sewered. Approximately 119,000 m cu/day of sewage or 42% of the sewered waste undergoes purification in treatment plants. Only 23% of the total urban sewage potential or 28% of the sewered waste representing 79,000 m cu/day are being utilized at present. Tabulation is presented of the crops irrigated with municipal sewage including the areas irrigated and the quantity of sewage utilized. The mineral concentration and the per capita contribution from towns and agricultural settlements is also tabulated. A short discussion is also presented on oxidation ponds and their increasing use for waste water in Israel. (Hancuff-Texas)
W70-09760

AERATED GRIT CHAMBER WITH TANGENTIAL INLET,
Technical Univ. of Prague (Czechoslovakia).
Z. Konicek, and I. Pardus.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 8 p, 8 fig, 7 tab, 7 ref.

Descriptors: *Aeration, *Energy, *Bubbles, *Flows, Inlets, Mathematical models, Velocity, Efficiencies, Circulation.
Identifiers: *Grit removal.

Spiral flow in an aerated grit chamber is produced by artificial aeration along its longitudinal wall. Components of both horizontal and cross velocity form a spiral current. The aeration should be strong enough to insure a final water velocity of 25 to 30 cm/sec 5-10 cm above the bottom of the chamber. The detention time at dry weather flow should be at least 1.5 min. The mean horizontal velocity in the grit should not exceed 30 cm/sec and the length of the chamber should correspond at least to a triple spiral. The hydraulic conditions of the chamber may be improved by the addition of a longitudinal baffle placed along the aeration system and the efficiency of the grit chamber can be enhanced by placing the water outlet in the center of the cross-sectional area. In analyzing the optimum conditions for grit removal design an energy balance is utilized and extensive mathematical munipulation are carried out. Results of calculations are compared with results obtained by direct measurement. In the tests made the detention time varied from 3.1 to 9 minutes and in all tests the optimum detention time proved to be approximately 7 minutes. Efficiency tests at different aeration intensities were also made varying the flow from 1.03 to 1.1 m cu/sec. The grit chamber without a baffle indicated the optimum aeration is approximately 40 Ncm cu/hour. (Hancuff-Texas)
W70-09761

THE INFLUENCE OF WASTE WATER CONCENTRATION ON THE ACTIVATED SLUDGE PROCESS EFFICIENCY,
Water Economics Research Inst. Warsaw (Poland).
J. Ganczarzyk, and S. Bachanek.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 4 fig, 2 tab, 7 ref.

Descriptors: *Activated sludge, *Sewage treatment, Efficiency, Mathematical models, Chemical oxygen demand, Kinetics, Organic loading, *Waste water treatment.
Identifiers: Fiber Board.

Waste water from the production of fiberboard contains a complicated mixture of dissolved and colloidal organic substances which has a range of concentration from 7,300 to 42,000 mg/l COD. These are primarily colloidal carbohydrates and to a lesser extent furfurol, lower alphatic acids, alcohols, aldehydes and ketones. Dissolved oxygen levels of 1 to 2 mg/l were maintained throughout the experiments as well as a constant ratio of mineral nutrients to the BOD load with BOD:N:P equal 100:5:1. The pH was between 7 to 7.5 and the temperature was between 18 deg C and 20 deg C. The dependent variables in each experiment were: the concentration of the influent, suspended solids contained in the aeration tank (3.15 to 11.17 g/l), and the waste water aeration period (2.9 to 123 hours). The experimental results amounting to 660 separate measurements were statistically analyzed with the use of the Least Squares Method and calculated correlation factors were verified by the Students Test. These results were not interpreted either according to the Michaelis-Menten theory nor the two-phase hypothesis, but were generalized on the basis of the equation for a retardant reaction. It was concluded that under some conditions it is possible to use the activated sludge treatment even for very concentrated waste waters. (Hancuff-Texas)
W70-09762

OXYGEN UPTAKE AND MECHANISM OF SUBSTRATE PURIFICATION IN A MODEL TRICKLING FILTER,
Cornell Univ., Ithaca, N.Y.
P. Monadjemi, and V. C. Behn.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 16 p, 14 fig, 6 ref.

Descriptors: *Trickling filters, *Mathematical models, Depth, *Films, Slime, Dissolved oxygen filtration, Chemical oxygen demand, Sewage treatment, Waste water treatment, Oxygen demand.
Identifiers: *Oxygen uptake, Purification.

A mathematical formulation is presented modeling the activity of the trickling filter. The basic assumptions in the development of this formulation are: (1) the flow of each individual element approximated to be of cylindrical shape is laminar with molecular diffusion as the prevailing means of mass transfer in the liquid layer, (2) at the point of contact of each element with the one immediately above or below it mixing of the liquid occurs, (3) the available active surface of slime film and the quality of it is constant in each element and from element to element for the biochemical oxygenization is not rate determining, (4) the substrate used is in the form of soluble nutrient, (5) the filter elements are packed in cubical fashion, (6) the waste has only one single compound. The mathematical model developed shows that the log of the portion of the substrate remaining is a linear function of depth. The oxygen uptake model is developed based on the same or similar assumptions. A dissolved oxygen profile was obtained using glucose as a substrate. The oxygen uptake in the filter was in the order of 10 mg of O2 per hour per gram of slime film. Calculations for the top sections indicate that the uptake was about 13.6 mg O2 per hour per gram of slime film and for the bottom sections 7.1 mg O2 per hour per gram. (Hancuff-Texas)
W70-09763

SOME FACTORS AFFECTING THE EFFICIENCY OF HIGH-RATE BIOLOGICAL FILTERS,
Water Pollution Research Lab., Stevenage (England).
A. M. Bruce.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 8 p, 4 fig, 3 tab, 9 ref.

Descriptors: *Trickling filter, Films, Surfaces, Materials, *Biological treatment, *Filtration, Biochemical oxygen demand, Pilot plants, Sewage treatment.

Observations have been made over a 12 month period of the performances of six pilot scale biological filters containing different types of media. When receiving settled domestic sewage at a rate of 6 m cu/day the BOD removal efficiency of filters containing plastic sheet packings for mineral aggregate medium was related in a fairly consistant manner to the specific surface area provided by the medium. A tubular plastic medium demonstrated a lower efficiency than the other media in relation to the specific surface provided. The effect of temperature on performance was pronounced and the calculated value of the temperature coefficient was much greater than that which has been found in studies elsewhere. In analyzing the seasonal effects due to temperature changes the temperature coefficient C was found to range between 1.1 and 1.035 with a mean 1.21. This value was substantially greater than the value 1.035 normally applied to lightly loaded precolating filters. The temperature range of this study was between 18 deg C to 9 deg C which caused a fivefold change in oxygen uptake or substrate utilization. (Hancuff-Texas)
W70-09764

A MATHEMATICAL MODEL OF SELF-PURIFICATION PROCESS IN A CANALIZED HIGHLY POLLUTED RIVER,
Water Economics Research Inst., Wroclaw (Poland).
H. Manczak, and R. Kransnodebski.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 7 p, 2 tab, 6 ref.

Descriptors: *Mathematical models, *Rivers, *Self-purification, *Dissolved oxygen, Oxygen sag, *Biochemical oxygen demand, Water pollution, Reaeration, Kinetics.
Identifiers: *Suspended solids.

Results of research on the self-purification capacity of the Odra river along it's course of 264 km are utilized to construct a mathematical model for describing the oxygen sag curve. The research was based on hydrographic, hydrometric and hydronomic measurements. The measurements have been performed during four periods. In winter when the river was covered with ice, in winter when it was free of ice, in summer, and in autumn. The data namely BOD5 and DO obtained from these measurements served as a basis for construction for the mathematical model of the oxygen utilization process and of the dissolved oxygen curve. Three basic assumptions are made in the construction of this model: (1) the changes of pollution of oxygen content in the stream caused by waste water discharge by tributaries or by weirs are stepwise, (2) the changes of the flow of the stream caused by tributaries are stepwise also, (3) the reaeration coefficent is a function of BOD5, (4) in every interval the BOD process in deoxygenization are first order processes and constant. (Hancuff-Texas)
W70-09765

NEW DEVELOPMENTS IN THE DESIGN OF ACTIVATED SLUDGE TANKS WITH LOW B.O.D. LOADINGS,
Dwars, Heederik, and Verhiey Ltd., Amersfoort (Netherlands).
J. Zeper, and A. De Man.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 10 p, 11 fig.

Descriptors: Design, *Activated sludge, *Organic loading, *Biochemical oxygen demand, Energy turbulence, Aeration model studies, Testing, Mathematical models, Efficiency, Prototypes.
Identifiers: Carrousel tank, *Aeration tank.

In the activated sludge tanks the energy needed to keep sludge floc in suspension amounts to 15 to 25 watts/m cu. With BOD loadings below 1 kg/m per day this value often exceeds the energy needed for oxygen transfer. In oxidation ditches with BOD loadings as low as 0.2 kg BOD/m day sludge floc are kept in suspension by the uniform turbulent flow in the ditch. The 5 to 8 watts/m cu needed for oxygen transfer by cage rotors are sufficient to generate suspension turbulence in the ditch. Model tests have shown the feasibility of generating an adequate uniform turbulent flow in oxidation ditches using surface aerators with a vertical axis. The tests on a prototype oxidation ditch with 3,500 m cu liquid content proved the possibility of this arrangement. This new type of activated sludge tank, the Carrousel tank, combines the advantages of high oxygen transfer efficiency and a confined aeration zone adapted to the size of the aerator. With low energy demand for suspension of sludge floc in flow channel within the tank 3 to 5 watts/m cu were found to be sufficient. Design data are given for Carrousel tanks now under construction. Among these are three large oxidation tanks of 19,000 m cu each, as well as an activated sludge plant with 4 tanks of 2,900 m cu each. (Hancuff-Texas)
W70-09766

TURBULENCE DIFFUSIVITY IN ACTIVATED SLUDGE AERATION BASINS,
Utah Water Research Lab., Logan.
A. A. Kalinske.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 16 p, 3 fig, 24 ref.

Descriptors: *Turbulence, *Diffusivity, *Activated sludge, *Aeration, Waste water treatment, Biological treatment, Energy, Mass transfer, Mathematical model, Kinetics.
Identifiers: Aeration basins, Agitation, Floc Gradients.

In the study of complex turbulence fields in activated sludge aeration basins one must consider the parameters which are pertinent to the particular process that is being considered. No overall general average characterization of the turbulence in such basins is of much value. The customary criteria of energy input (average velocity gradients) as calculated from the power input is not sufficient to characterize the turbulence involving air bubbles and floc matricies. Of greater importance are the turbulence intensities usually expressed as the mean square velocity function and the energy dicipating eddies, as shown by a turbulence spectrum. High intensity in small scale eddies of a size comparable to the floc will increase the various process transfer rates by increasing the applicable diffusivity and by floc disintegration to expose as much of the microbial surface as possible. Diffusers are reported to have inherent limits so far as controlling the intensity and scale of the turbulence are concerned, and mechanical means such as turbines are suggested to generate high localized fluid shear and large amounts of microturbulence. This is considered to be of particular importance where oxygen enriched air or pure oxygen may be used for treating strong wastes maintaining high values of DO or using high concentrations of suspensions. (Hancuff-Texas)
W70-09767

GENESEE COUNTY, MICHIGAN PUBLIC WORKS PLAN FOR WATER POLLUTION CONTROL.
Consoer, Townsend and Associates, Flint, Mich.

Engineering report to Genesee County Drain Commissioner, Flint, Michigan, January 1970. 104 p, 30 fig, 3 tab. HUD Project No. P-MICH 3241.

Descriptors: *Sanitary engineering, *Sewers, *Sewage treatment, *Long term planning, *Urbanization, *Water resources planning, *Programs, *Coordination, *Pollution abatement, *Water pollution control, *Waste water treatment, Municipal wastes, Construction costs, Operating costs, Project planning.
Identifiers: *Sanitary sewers, Public works planning.

A county-wide public works plan is described for water pollution control in Genesee County, Michigan. The plan for sewers and sewage treatment was initiated by the County Drain Commissioner in anticipation of potential problems from expansion of service areas, relief sewer requirements, flows from outside Genesee County, and overloads on present waste water treatment facilities. The purpose of the plan is to provide a sanitary sewerage system designed to handle ultimate needs when the County and contiguous tributary area attain full development. All existing sewer systems and future construction would ultimately be merged into an integrated system. At present, the City of Flint provides waste water treatment for County flows from one of six County sewage disposal districts. Two alternative plans are presented for sewage disposal. One is to continue the agreement with Flint and participate in plant expansion. The other is to expand the capacity of a county treatment plant and construct the trunk sewer necessary for flow diversion. Descriptions of recommended improvements, expansion and additions to the sewer systems and waste water treatment facilities, together with estimates of construction costs and operating costs, are included. Methods of financing are discussed. (Poertner)
W70-09796

COMMUNITY ACTION PROGRAM FOR WATER POLLUTION CONTROL.
National Association of Counties Research Foundation, Washington, D.C.

July 1967. 182 p, 65 fig, 2 tab, 73 ref. FWPCA Demonstration Grant WPD 55-04-67.

Descriptors: *Water pollution control, *Local governments, *Programs, *Community development, *Urbanization, *Municipal wastes, *Pollution abatement, *Legislation, *Planning, *Financing, *Treatment facilities, *Waste water treatment, *Water quality control, Sewage treatment, *Project planning, Administration, Personnel management, Training, Compensation, Administrative agencies, Operation and maintenance, Design, Sewerage, Sewers, Construction.
Identifiers: *Community action programs, *Guidelines, Organization, Implementation programs.

Ten community action guides for water pollution control are presented to provide policy-making officials of local governments with guidelines on all aspects of planning, design, organization, financing and operation of programs to prevent and abate water pollution. The information was obtained from officials in nearly 60 communities with successful anti-pollution programs. The ten action guides, each presented as a chapter of the publication, are: Enabling Legislation for Pollution Control Programs; Area-wide Approach to Pollution Control Programs; Planning Pollution Control Programs; Organization of Pollution Control Programs; Construction of Collection and Treatment Facilities; Financing of Pollution Control Programs; Technical and Financial Assistance Available to Localities; Gaining and Maintaining Public Acceptance for Pollution Control Programs; Staffing Pollution Control Facilities; and An Action Plan for Instituting Community Pollution Control Programs and Bibliography of Pollution Control Literature. These action guides are designed to be useful to community leaders, local officials, engineers, managers, finance experts, attorneys and others who have responsibility for portions of a total pollution control program. Illustrations and photographs are included. (Poertner)
W70-09800

RESEARCH AND PRACTICE IN ANIMAL WASTES TREATMENT,
Lilly (Eli) and Co., Lafayette, Ind. Tippecanoe Labs.
Robert H. L. Howe.
Water and Wastes Engineering/Industrial, Vol 6, No 1, January 1969. p A14-A18, 6 fig, 7 tab, 6 ref.

Descriptors: *Animal wastes, *Waste treatment, *Waste water treatment, *Industrial wastes.
Identifiers: *Packing house wastes, Population equivalents.

In recent years, the problem of animal and dairy wastes has grown larger due to increased demands for more effective control of wastes discharges to streams and due to the increased demand for more food to feed our ever growing population. BOD content of various animal wastes were studied and it was found that cattle produce 6.5 lbs BOD/day or 27 times the amount produced by humans, which was found to be 0.17 lbs/day. Hogs produce 0.85 lbs BOD/day and chickens, 0.07 lbs BOD/day. Experience indicates solid and liquid wastes should be handled separately for reasons of economy. Traditional methods of disposal and treatment were observed, and some research was conducted in physical and chemical methods of treatment, especially in the area of coagulation. Animal processing wastes were found to require solids separation and recovery before treatment by conventional means. Listings of the processes used and flow charts are given to illustrate the treatment of the animal processing wastes. It is recommended that further research in treatment and handling of animal wastes, and improvement of efficiency and economy of treatment be made. Segregation of wastes and recovery of by-products are also recommended as ways to increase economy. (Makela-Texas)
W70-09803

CATAD SYSTEM CONTROLS FOR REGULATION OF COMBINED SEWAGE FLOWS,
Charles V. Bibbs, and Stuart M. Alexander.
Water and Wastes Engineering, Vol 6, No 8, August 1969. 66-69 p, 2 fig, 1 tab.

Descriptors: *Automatic control, *Telemetry, *Remote control, Mathematical models, Treatment plant.
Identifiers: *Collection systems, *Interceptions, *Combined sewers, Trunk sewer, Outfalls, Pumping stations, Digital counter.

Combined sewers are designed to utilize the maximum storage during periods of high flow. A computer augmented treatment and disposal system (called CATAD) proposed for the municipality of metropolitan Seattle is described. This program enables the minimization of the overflow of combined sewage. Existing local station controls and the principal objectives of the system controls are outlined. The paper also describes how the desired degree of control is achieved by the new system. Various components of the system and their primary functions are presented. A description of a mathematical model which will automatically control the system is presented. Apart from acting as a control for the combined sewage flow, the system also does recording and storing of water quality data for later analysis. The system has a good capability for future expansion. (Radhakrishnan-Texas)
W70-09804

FEDERAL PROGRAMS STUDY WASTES FROM RAW AGRICULTURAL PRODUCTS,
Agricultural Research Service, Washington, D.C.
Sam R. Hoover.
Industrial Wastes, Vol 116, No 11, November 1969, p 22-25. 2 tab, 4 ref.

Descriptors: *Environment, *Wastes, *Domestic wastes, *Biochemical oxygen demand, *Solid wastes, By-products, Tertiary treatment, Incineration, Water pollution.
Identifiers: *Population equivalent, *Agricultural processing wastes, Molasses, Land disposal, Food processing plants, Salt water intrusion.

The direct and indirect effects of agricultural wastes on pollution of the environment are discussed. Attempts made by various agencies to assess the magnitude of the problem are outlined. Various methods by which pollution from agricultural products can be minimized include food processing methods, methods of harvesting, improved methods of peeling vegetables, efficient separation and removal of solid wastes from processing stream, new processing methods and recovery of by-products. Some of the effects of controlling pollution are also mentioned. Out of the various recommendations made to improve control of agricultural pollution the broad and specific areas where research needs to be done are also pointed out. The main purpose of the research will be to know to what extent the improved methods can minimize pollution from agricultural wastes. Finally the research programs undertaken by the various federal agencies to control pollution arising out of wastes from agricultural products are presented. (Radhakrishnan-Texas)
W70-09805

DISPERSED AIR FLOCCULATION/FLOATATION FOR STRIPPING OF ORGANIC POLLUTANTS FROM EFFLUENTS,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. Van Vuuren, G. J. Stander, M. R. Henzen, S. H. V. Van Blerk, and P. F. Hamman.
Water Research, Vol 2, No 2, February 1968. 177-183 p, 3 fig, 1 tab, 5 ref.

Descriptors: *Sewage effluent, *Dissolved oxygen, *Flocculation, Adhesion, Aeration, Ponds, Lagoons.
Identifiers: *Organic pollutants, *Floatation, *Activators, *Humus tank, Retention period, Maturation pond.

Basic principles underlying dissolved air and dispersed air floatation techniques are discussed. Some methods used by other investigators for dispersed air floatation technique are also presented. A small scale dispersed air floatation unit which was developed for separating organic pollutants from sewage effluents is described. A modified dispersed air generating system was developed by the suction of air into the pump impeller. This technique is advantageous in that it avoids high pressure floatation equipment. The laboratory scale unit was found useful to determine the basic design criteria for similar equipment to be used for a pilot-scale plant. (Radhakrishnan-Texas)
W70-09806

THERMAL TREATMENT OF SEWAGE SLUDGE,
A. Bjorkman.
Fourth International Congress of the International Research Group on Refuse Disposal, Proceedings, Based, June 2-5, 1969. N.P., N.D. p 682-686.

Descriptors: *Dehydration, *Incineration, *Sewage, *Sewage sludge, *Sludge treatment, Sludge, Sludge disposal.
Identifiers: *Hygienization, *Thermal treatment, Raw sewage, Chemical-thermal process.

Working Group Six of the 4th International Congress of the IRGR discussed four main issues of sludge treatment: hygienization, dehydration, drying, and incineration of sewage. The necessity for hygienization destroying the pathogenic germs in order that the sludge can be used in agriculture without any danger of infection was discussed. Problems concerned with use of sewage for irrigation were also discussed, for example groundwater pollution and heavy metal accumulation in soil. Thermal treatment for the purpose of dehydrating was evaluated emphasizing the exclusion of soil pollution, using drying beds, digestors or chemical admixtures as advantages. The discussion delt mainly with the problem of what treatment should be applied to the highly polluted effluent of dehydration. Multi-use plants for both drying and incineration were described. (Waid-Texas)
W70-09807

THERMAL TREATMENT OF SEWAGE SLUDGE,
A. Bjorkman.
Fourth International Congress of the International Research Group on Refuse Disposal, Proceedings, Bosel, June 2-5, 1969, N.P., N.D., 670-681 p.

Descriptors: *Dehydration, *Incineration, *Sludge, *Sewage, Oxidation, *Sludge treatment, Sludge disposal.
Identifiers: *Hygienization, *Thermal treatment, Raw sewage, Wet incineration, Fluidized bed.

Thermal treatment plays a growing role in the disposal of sewage sludge. It is used to pasteurized sewage for agricultural use. Hygienists recommend a temperature of 70 deg C for 20-25 minutes for pasteurization. Heat and pressure coagulate the solid materials contained in sludge, destroy the cell walls and release the strong binding of sludge water to solid materials. Treatment at 200 deg C and under 15 atmospheres pressure allows mechanical dehydration processes to obtain residual water content of 40-44%. Heat treatment is also applied in several drying processes such as multiple hearth dryers, drying drums, flash drying systems or a belt dryer. If the sewage cannot be used it can be incinerated and the smallest possible residues then disposed of. Fluidized bed incineration and wet incineration are described. Liquid or dehydrated sludge can also be incinerated in appropriate devices jointly with good results. (Waid-Texas)

W70-09808

REUSE OF INDUSTRIAL COOLING WATER,
Water Service Labs., Inc., New York.
Sidney Sussman.
Water and Wastes Engineering, Vol 6, No 1, Jan 1969. p A6-A10, 2 fig, 2 tab, 5 ref.

Descriptors: *Cooling water, *Water reuse, *Cooling towers, Cooling, Water conservation, Corrosion control, Alkalinity, Evaporation.
Identifiers: Blowdown.

Industrial cooling is both one of the largest uses of water and one of the largest examples of water reuse. In 1964, water withdrawal for industrial cooling in the U.S. was estimated at 44.7 trillion gallons. Of this amount, 99% was used in once through cooling, and only 500 billion gallons was used as makeup for recirculating cooling systems in which the water was reused repeatedly. Due to the tremendous volume of water used, only the most essential, very minimum, and least expensive treatment is given the water. This may include straining, sedimentation, chlorination, and corrosion control. In water short areas, secondary effluent from municipal waste water treatment plants can be effectively used for makeup water source. Both closed and open cooling systems are employed. Open systems include cooling towers, evaporative condensers, and evaporative coolers. Evaporative coolers work on the principle of removal of heat as latent heat of evaporation. Use of evaporative coolers can reduce water intake as much as 98% over once thru cooling systems. Problems occur due to chemical composition changes in cooling water from evaporation and exposure to air. Evaporation of water results in an increase in dissolved solids concentration which results in scale formation. Exposure to air results in an equilibrium between gases in the air and the water. (Waid-Texas)
W70-09809

BIODEGRADATION OF SURFACTANT BENZENE RINGS IN SHAKE CULTURES,
Monsanto Co., St. Louis, Mo. Inorganic Chemicals Div.
R. D. Swisher.
Developments in Industrial Microbiology, Vol 9, 1968. 270-279 p, 5 fig, 1 tab, 11 ref.

Descriptors: *Biodegradation, *Surfactant, *Microorganisms, Degradation (Decomposition).
Identifiers: *Benzene ring, *Shake-culture, *Ultraviolet analysis, *Acclimation, Biodegradation, Pathways, Interference, Deacclimation, Cross acclimation.

The work is undertaken to determine whether ring degradation could be achieved under milder conditions characteristics of the shake culture biodegradation test methods. Two pure isomers representative of the components of linear alkylbenzene sulfonate (LAS) were studied, the 3-phenyl and 6 phenyldodecane sulfonates conditions of the standard shake culture biodegradation test method using a culture already acclimated to mixed LAS, were modified to permit (a) use of the characteristic 193 and 223 mu ultraviolet absorption bands for detection of the benzene rings (b) acclimation of the cultures to accomplish ring degradation. After full acclimation the extent of ring degradation of both isomers was at least 80% and may have been 100%; spectroscopic interferences preclude calculation of the exact value. Acclimation to 6 phenyl ring degradation includes acclimation to the 3-phenyl isomer also, but not vice versa. This suggests that the biodegradation pathways may be significantly different for the two isomers. Interference by nitrate in biodegradation of benzene, toulene, etc. characterized by development of strong absorption below about 240 mu in the control culture is also noted. Acclimation rates, ring degradation rates, cross acclimation effects were analyzed. (Shankar-Texas)
W70-09810

PRETREATMENT OF SEWAGE SLUDGE,
Technische Hochschule, Aachen (West Germany). Institut fuer Siedlungswasserwirtshaft.
B. Boehnke.
Fourth International Congress of the International Research Group on Refuse Disposal, Proceedings, Bosel, June 2-5, 1969. N.P., N.D., p 615 - 631.

Descriptors: *Sludge, *Stabilization, *Operations, *Sewage sludge, *Pretreatment, *Cost, Vacuum drying, Filtration, Lagoons, Drying, Dewatering.
Identifiers: *Sludge thickening, Drying beds, Vacuum-filtration, Pressure filtration, Conveyor screen press.

A summary of the meetings and discussions of the working group 5 of the 4th International Congress of the IRGR is presented. The theme is discussed under eight sections, namely: (1) criteria for the degree of aerobic and anaerobic sludge stabilization. (2) Operational experience and cost of the following: (a) aerobic and anaerobic sludge stabilization, (b) sludge thickening, (c) centrifugation while considering pre-conditioning, (d) sludge processing in drying beds and sludge lagoons, (e) vacuum filtration while considering pre-conditioning, (f) pressure filtration while considering preconditioning, and (g) sludge dewatering through conveyor screen presser. Based on the above studies is concluded that there is no ideal process for sludge treatment but an adequate solution can be found for every particular case. The choice of treatment depends on the sewage plant and partly on the possibilities available for final sludge disposal. The choice of the process depends also on the objective assigned to the particular treatment stage. Cost figures are given for some of the processes. Since it is difficult to say with certainty the most economical combination of two or more processes, it is advisable to make tests. Much progress has been made in the different processes mainly due to high molecular weight flocculants. (Shankar-Texas)
W70-09811

PERFORMANCE OF (ACTIVATED SLUDGE) SECONDARY SEDIMENTATION BASINS,
Peter Pflanz.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 15 p, 7 fig, 2 tab, 10 ref.

Descriptors: *Settling basin, *Activated sludge, *Effluent, Biochemical oxygen demand, Aeration, Efficiencies.
Identifiers: *Aeration tank, Detention time, Solids concentration, Sludge volume index, Suspended solids.

Tests conducted at Hannover in various activated sludge plants are discussed with a view to determining the relationship between solids concentration of activated sludge, detention time and suspended solids in the effluent from secondary sedimentation. A description of the plants studied is presented. The sedimentation rate of the activated sludge is dependent upon a series of factors, the most important being the dry solids matter content of the sludge. The sedimentation process in the secondary basin is demonstrated with solids profiles. Tests showed that an increase in the solids content in the effluent is followed by an increase in the BOD. The relationship between BOD and suspended solids in the effluent varies for different plants. A useful criterion for dimensioning secondary settling basins is the product of the overflow rate and the suspended solids content of the mixed liquor. With readily setteable sludges (SVI=100 ml/g) the maximum solids feed can be as high as 3.5 kg SS/m sq hr. At a SVI of 200 ml/g the maximum solids feed decreases to approximately 1.1-1.3 kg SS/m sq hr. When the sludge volume index is increased to 300 ml/g a maximum solids feed of 0.8-1.1 kg SS/m sq hr must be considered in a secondary basin, if the solids content in the effluent is not to exceed 30 mg/l. (Shankar-Texas)
W70-09812

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
W. Niemitz.
Fourth International Congress of the International Research Group on Refuse Disposal, Basel, June 2-5, 1969, N.P., N.D., p 425-435.

Descriptors: *Sludge, *Sludge disposal, Industrial waste, Aerobic treatment, Anaerobic treatment, Digestion, Dewatering, Neutralization, Pre-treatment (Water), Sedimentation.
Identifiers: *Industrial sludge, Petrification, Polyelectrolytes, Composting.

A definition of 'industrial sludge' was presented through its characteristics which are generally: (1) a tremendous variability as to types of sludges produced in the various industries and, (2) the composition of a specific sludge is usually more homogeneous than in domestic sludge. In order to further define 'industrial sludge' a summary of essential specific and general facts and findings already fully acknowledged were listed and include: (1) processing and disposal methods should be as flexible as possible and include efforts to re-use waste materials, (2) possibilities of joint processing and disposal of industrial and municipal refuse should be studied, (3) sludge should not only be dewatered as far as possible but also be stabalized biologically, before any disposal. (Waid-Texas)
W70-09813

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
W. Niemitz.
Fourth International Congress of the International Research Group on Refuse Disposal, Basel, June 2-5, 1969. N.P., N.D., p 436-443.

Descriptors: *Lagoons, *Sludge disposal, Groundwater, Incineration, Industrial waste, Standards, Sewage, Sludge, Dewatering.
Identifiers: *Standardization, *Pre-treatment, *Compost, *Wet-air oxidation, Refuse disposal, Model sludges.

The conclusions of the lectures and discussions of working group two of the fourth Congress of the IRGR are presented. A complex account of the variety of possibilities to characterize industrial sludges were given with respect to pre-treatment and disposal. It was concluded that standardization was necessary to calibrate research methods and give comparable data. This idea was supplimented by a presentation on the usefulness of calibration sludges or model sludges in paper production. The suitability of lagoons for the treatment of sludges was surveyed and the need to take into account the different functions possible for successful operations was emphasized. The immediate spreading of sludges over suitable areas after insuring no soil damage or groundwater pollution was discussed. The working group also discussed several methods of sludge disposal and in general concluded that research should be intensified and that considerable improvement be made in the exchange of information of the research groups concerned. (Waid-Texas)
W70-09814

FLUIDIZATION OF FLOCS PRODUCED IN CHEMICAL OR BIOLOGICAL TREATMENT PLANTS,
Centre Belge d'Etude et de Documentation des Eaux, Liege; Technical Coll. of Transport Engineering, Zillina (Czechoslovakia); and Hydraulic Research Inst., Brno (Czechoslovakia).
F. Edeline, I. Tesarik, and J. Vostrcil.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 9 p, 7 fig, 1 tab, 2 ref.

Descriptors: *Activated sludge, *Sedimentation, *Biological treatment, Settling velocity, Waste water treatment, Reynolds number.

dentifiers: *Fluidization, *Clarification, *Flocs, uspension density.

t is claimed that upflow clarification results in igher efficiencies for the same clarification surace when compared with conventional sedimentaion. The advantages may be a better removal of uspended matter, or a higher permissible flow per nit area or both. Theoretical relationships pertaing to this phenomenon for flocculated matter and or living flocs from activated sludge are eveloped. General theory relative to fluidization f particles is discussed. Classical formula for uidization of particles is assumed to be valid for ocs in the region of Reynold's numbers between -30. Experiments with the fluidization of a layer of ocs produced by chemical treatment were perormed in a cylindrical transparent model epresenting the clarifier produced by the ralovopolska factory in Brno, Czechoslovakia. rom the results, the relation between volume conentration and suspension densities are established. omparison between fluidization and sedimentaon velocities for the same suspension show that ie agreement is fair, with settling velocity slightly wer than fluidization velocity. The same is true or biological flocs in activated sludge. The descripon of physical properties of the fluidization rocess by these formulae yields coefficients which ay be helpful in appreciating qualities of the flocs rmed either chemically or biologically. (Shankar-exas)
/70-09815

IODIFIED FILTER MEDIA FOR REMOVAL F WATER POLLUTANTS,
idian Inst. of Tech., Kanpur. Dept. of Civil Enneering.
. D. Agrawal, and A. V. S. Prabhakara Rao.
ourth International Conference on Water Polluon Research, Prague, September 2-6, 1968. reprint, 9 p, 5 fig, 10 ref.

escriptors: *Filter, *Filtration, Coagulation, Effiency, Head loss, Turbidity, Waste water treatent.
lentifiers: *Electro-Kinetic force, Surface Potenal, Filter media, Bauxite media.

he development of a simple filter with modified edia for efficient removals of micro sized parties is discussed. The efficiencies of filtration can significantly improved by suitably altering the rface properties of media with more desirable rface potentials. Higher filtration efficiencies ere obtained when filter media were coated with tionic polyelectrolytes to give a positively anged media, to effectively remove and retain e negatively charged particles. With such filters lvance coagulation with alum or ferric chloride n be obviated and the process thus simplified. rther the head loss build up on such a filter is uch slower and the removals are more uniformly stributed through the bed. The results of instigation of alternative filter media and coatings form a positively charged layer on sand to give ficient filtration of natural waters without any etreatment are discussed. Less than 10 mg/l. turdity could be produced by filtration of raw stream ater or pond water, through crushed bauxite or nd coated with Al2SO3 or Fe2O3. (Shankar-Tex-)
70-09816

REATMENT OF WASTE WATERS FROM RAFT-CELLULOSE FACTORIES,
stitute of Hydrotechnical Research, Bucharest tumania).
Munteanu, E. Cute, and C. Negulescu.
ourth International Conference on Water Pollun Research, Prague, September 2-6, 1968. eprint, 10 p, 10 fig, 12 ref.

escriptors: *Waste water treatment, *Biological eatment, *Sludge treatment, Organic loading, Efiency, Foaming, Biochemical oxygen demand, enol, Aeration.

Identifiers: *Pilot plant, *Mechanical treatment, Settling tanks, Hydraulic loading, Aeration channels, Drying beds.

A semi industrial pilot plant was built to test the treatment of waste waters from kraft-cellulose factories and to determine the parameters useful for plant design. Investigations were carried out over a period of 250 days using mechanical treatment, biological treatment and sludge treatment. Two types of settling tanks were used in the investigation using mechanical treatment. It was concluded that upward flow settling tanks allow hydraulic loadings twice as great as those in radial flow tanks with the same treatment efficiency. However, the use of upward flow settling tanks is not recommended due to a strong foaming tendency. The sludge from mechanical treatment does not readily undergo bacterial decomposition. The biological treatment of the waste water was tested using small scale aeration tank with air injected at reduced pressure. The waste water after settlement easily responded to biological treatment provided it was furnished with mineral requirements for bacterial growth. The treatment by activated sludge gives satisfactory results at short aeration periods when partial treatment of the wastes is required and it was found that phenol in the waste water could be removed completely by this method. (Shankar-Texas)
W70-09817

ACTIVATED SLUDGE PROCESS MODIFICATION FOR NITROGEN-DEFICIENT WASTES,
Oklahoma State Univ., Stillwater, and Nalco Chemical Co., Chicago, Ill.
A. F. Gaudy, Jr., K. C. Goel, and A. J. Freedman.
Fourth International Conference on Water Pollution Research, Prague, September 2-6, 1968. Preprint, 11 p, 8 fig, 1 tab, 4 ref.

Descriptors: *Activated sludge, *Chemical oxygen demand, *Biochemical oxygen demand, *Nitrogen aeration, Operations, Waste water treatment.
Identifiers: *Nitrogen-deficient wastes, *Operational feasibility, *Sugar refinery, Mechanical feasibility, Detention time, Endogenous-aerator, Plug flow.

The mechanistic feasibility of activated sludge process using whole waste and the operational feasibility of the process under conditions of continuous waste flow is investigated. A nitrogen deficient industrial waste was selected for use in this research and it consisted of sugar refinery effluent. a large fraction of soluble organic matter in the sugar refinery waste was assimilated by the sludge in the absence of an exongenous nitrogen source. The sludge thus synthesized readily settled under quiescent conditions and the supernanant contained relatively small amounts of organic matter A significant portion of the cell constituents of the settled sludge, (converted to protein in the endogenous aeration phase in the presence of extracellular nitrogen) regenerated the COD removal efficiency of the sludge. This was exhibited by its nitrogen retention ability upon recycling to the feeding aerator. The process was operated successfully at a detention time of 5 hours, a COD: N ratio of 60:1 and COD: P ratio of 140:1. COD of the sugar refinery waste varied widely during the study. It was felt that aeration solids levels employed in these studies could be treated successfully with pH adjustments or control. It appears that the process will give good results on wastes which are not purely carbohydrate in nature, and may thus find wide applicability for nitrogen deficient industrial wastes. (Shankar-Texas)
W70-09818

INVESTIGATION OF THE USE OF HIGH PURITY OXYGEN AERATION IN THE CONVENTIONAL ACTIVATED SLUDGE PROCESS,
Union Carbide Corp., Tonawanda, N.Y. Linde Div.
J. G. Albertsson, J. R. McWhirter, E. K. Robinson, and N. P. Vahldieck.

Available from the NTIS as PB-194 241, $3.00 in paper copy, $0.65 in microfiche. Federal Water Quality Administration Water Pollution Control Research Series, May 1970. 186 p, 29 fig, 62 tab, append. FWQA Project 17050DNW--5/70.

Descriptors: *Sewage treatment, *Activated sludge, *Oxygenation, Aerobic treatment, Sludge digestion, Sludge treatment, Oxidation.
Identifiers: Sludge oxygenation.

A full scale system designed to demonstrate the practical and economical use of high purity oxygen gas in aeration of the conventional activated sludge waste treatment process was tested under a variety of operating conditions in a direct performance comparison with a parallel air aerated system. A sparged-turbine, gas-liquid contacting unit was employed in covered tanks of conventional design with liquid and gas staging for cocurrent flow of each phase. This oxygenation system required very low power input for oxygen transfer and liquid mixing. The oxygenation system could operate with MLVSS concentrations of as high as 4500 mg/liter achieving about 90% BOD removals at aeration detention times as low as 1.2 hours (raw flow + recycle flow) treating domestic waste of 220 mg/liter BOD. Biomass from the oxygenation system is highly flocculent and readily settleable with desirable handling characteristics. Recycle and waste activated sludge suspended solids concentrations of about 3% were achieved. Process advantages recognized with the oxygenation system indicate significant reductions in secondary waste treatment costs in comparison to conventional diffused air aerated systems. (Knapp-USGS)
W70-09833

THE FATE OF NITROGENOUS COMPOUNDS THROUGH SEWAGE TREATMENT PLANTS,
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
Nava Narkis.
Washington Univ, St Louis, Missouri, Center for the Biology of Natural Systems, Environmental Field Program, February 1970. 52 p, 1 fig, 18 tab.

Descriptors: *Nitrogen compounds, *Sewage treatment, *Domestic wastes, Chemical analysis, Effluents, Trickling filters, Hydrolysis, Biological treatment, Activated sludge, Tertiary treatment, Ion exchange, Electrochemistry, Reverse osmosis, Electrodialysis, Distillation, Nitrification, Denitrification, Septic tanks, Oxidation lagoons, Land application, Bacteria, Algae, Symbiosis, Public health, Chlorine, Corrosion.
Identifiers: *Literature survey, Primary sewage treatment, Secondary sewage treatment, Physicochemical methods, Ammonia stripping, Guggenheim process.

Literature concerning nitrogenous compounds in sewage treatment plants is reviewed, especially emphasizing the modification or replacement of classical treatment operations to remove dissolved inorganic materials more efficiently. In primary treatment, nitrogen removal is low and sedimentation of suspended solids is the only physical process contributing to its total reduction. Returning supernatant liquor from sludge digesters to primary clarifier decreases nitrogen removal efficiencies. Clarified waste water from primary treatment may receive secondary treatment, normally a biological process, designed principally to reduce amount of suspended solids, oxygen demanding material and bacteria. Activated sludge and trickling filters remove 20% to 50% of the incoming nitrogen. Effluents from trickling filters contain high organic and ammonia nitrogen as well as nitrates and nitrites. It is possible to operate activated sludge processes to effect high nitrate concentrations, while ammonia nitrite and organic nitrogen concentrations are minimal. In the tertiary treatment, among the physicochemical methods for removing nitrogenous compounds from effluents, ion exchange and ammonia stripping are the only suitable methods presently efficient. Nitrogen removal by microbial denitrification seems economically

feasible. Septic tank effluents are analyzed. Stabilization ponds do not remove nitrogen compounds adequately. (Jones-Wisconsin)
W70-09907

HYDROLYSIS OF ACTIVATED SLUDGE,
Snell (Foster D.), Inc., Florham Park, N.J.
R. J. Bouthilet, and R. B. Dean.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 13 p, 15 fig, 9 ref.

Descriptors: *Activated sludge, *Sewage treatment, *Hydrolysis, Waste water treatment, Fertilizers, Filtration, Nutrients, Waste disposal, Biological treatment, Sludge.
Identifiers: *Refractory organics, *Biological solids.

Of concern in sewage disposal plants is the disposal of the solids which accumulate as a result of various separation procedures. Of particular concern is the disposal of activated sludge which is the solids residue resulting from aerobic digestion of soluble or non settleable solids in sewage. Various processes have been suggested to aid the thickening and clarification of these aerobic residues. These include addition of chemical coagulants and precipitants such as ferric chloride, polyelectrolytes, lime, alum, and others. Other treatments have evolved which involved conditioning the settled sludge before filtration. An improved process for the treatment of activated sludge has been developed. The process consists of heating of activated organic sludge in the presence of water and small amounts of sulphur dioxide. This treatment increases soluable solids, improves filtration efficiency by a factor of 100 and reduces the moisture conttne of the resultant filter cake. Concentration of the filtrate produced a molasses type syrup which from amino acid analysis and rat feeding studies could be of value as an animal feed. The cost of digesting 25,000 pounds of solids yielding a syrup containing 20% solids will be $160.69. Evaporation to molasses will cost $244. (Hancuff-Texas)
W70-09934

SLUDGE TREATMENT DISPOSAL AND UTILIZATION (Literature Review),
R. I. Dick.
Journal Water Pollution Control Federation, Vol 42, No 6, p 934-949, June 1970. 119 ref.

Descriptors: *Sludge, *Sludge treatment, *Sludge disposal, Sludge digestion, Dewatering, Incineration, Ultimate disposal, Fertilizer, Sewage treatment, Waste water treatment.
Identifiers: Characterization, Conditioning, Thickening.

Studies have been made to determine the optimum solution of the total waste treatment problem which includes socioeconomic evaluation and technical feasibilities. The treatability of sludges produced from advanced waste treatment largely have been ignored, and the sludges produced by the removal of phosphates through the precipitation with lime have created some difficult problems. The results of many investigators' studies on conditioning of sludge prior to dewatering is outlined. The use of polyelectrolytes quar gum, alum, flyash, lime and a variety of other sludge conditioners are discussed. Prethickening, freezing and thawing, and paramagnetic separation are a few newly proposed sludge conditoning processes. Gravity and flotation thickening are discussed in some detail and several pilot plant and full-scale process results are presented. In the discussion of sludge dewatering, several processes are evaluated: sand drying beds, vacuum filtration, centrifugation and mechanical gravity dewatering units. The calorific value of sludges is discussed in regard to sludge incineration and the recalcination processes for lime recovery evaluated. Many suggestions are presented for the ultimate disposal of sludge, including because of its commercial fertilizer value irrigation (Hancuff-Texas)
W70-09935

IMPLICATIONS OF MICROBIAL POLYMER SYNTHESIS IN WASTE TREATMENT AND LAKE EUTROPHICATION,
Ohio State Univ., Columbus.
P. R. Dugan, R. M. Pfister, and J. I. Frea.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint, 10 p, 9 fig, 13 ref.

Descriptors: *Nitrification, *Microbiology, *Waste water treatment, Sewage treatment, Synthesis, Aerobic, Treatment, Biological treatment, Metabolism, Adsorption, Flocculation, Natural streams, Lakes.
Identifiers: *Polymers, Cells, Natural waters.

The aggregation or flocculation of the biomass formed by microbial metabolic reactions results in settling and thereby provides a means for mechanically separating cells from supernatant. These processes are complicated by adsorption on suspended particles of inorganics as well as organics that are not readily oxidized. Adsorption is a physical-chemical phenomenon but the biological formation of adsorption sites on sludge floc also relegates this to a consideration which overlaps biology. The group of bacteria historically recognized as primary contributors to aerobic waste treatment were studied. All the floc forming bacteria have been observed to produce extra cellular polymer fibrils. The physical and chemical properties of these fibrils around different species of bacteria will determine the extent to which water is bound to the polymer and also determine solubility properties of the polymer and affinity for adsorption of dissolved chemicals. A discussion is presented on the relationship of ion adsorption to polymers and its relationship to waste treatment nitrification. The interactions among floc forming microorganisms found in natural waters, suspended solids, dissolved chemical and other particulates are similar to those observed in waste treatment systems. (Hancuff-Texas)
W70-09936

ENVIRONMENTAL SIMULATION AS A TOOL IN A MARINE WASTE DISPOSAL STUDY OF JAMICA BAY,
Rand Corp.
J. J. Leendertse.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 7 p, 2 fig, 4 ref.

Descriptors: *Computers, *Programme, *Simulation analysis, Ecology, Environment, Mass transfer, Mathematical model, Flows, Water pollution, New York.
Identifiers: *Marine disposal, *Jamica Bay (New York), Grids.

The study of technical solutions to the problem of managing fluid waste discharges in an estuary involves complicated relationships, such as those between waste load, location of discharges, degree of treatment, geometry of the estuary, flow in the estuary, and temperature. Models can be built to predict the probable consequences of each of the alternative solutions chosen. Such a model is being used and evaluated in a study of the extent and control of pollution in Jamica Bay, New York. A model of the fluid waste discharge establishes the relationship between the transport of pollution and the transporting medium. A reaction model is designed to describe the chemical and biochemical transformations. In the flow model velocities of the water in the region are computed together with the water levels. Because the tide state influences the location of the waters edge on the tidal flats, which effects surface area and cross sections to a considerable extent, such functional relationships are included in the model. The flow in the estuary is governed by the shape of the estuary and its boundaries at the sea and inland ends as well as by the tides and river discharges. The fluid waste loads in the system influence the pollution constituent transport while air temperatures, solar radiatio and exchange of gases at the water surface i fluence the reactions. (Hancuff-Texas)
W70-09937

TREATMENT-COST RELATIONSHIPS FO ORGANIC INDUSTRIAL WASTES,
National Inst. for Water Research, Pretoria (Sou Africa); and Texas Univ., Austin.
J. L. Barnard, and W. W. Eckenfelder, Jr.
Fifth International Water Pollution Research Co ference, San Francisco, July 26-August 1, 197 Preprint, 19 p, 5 fig, 7 tab, 7 ref.

Descriptors: *Industrial wastes, *Waste wat treatment, *Costs, *Mathematical model, Waste Water quality, Biological treatment, Organic loa ing.
Identifiers: Parameters, Characteristics.

The coming decade will see a large number plants constructed for the treatment of organ waste waters. These plants may treat industri wastes alone or industrial wastes in combinatic with domestic sewage. Various process combin tions can be employed to yield specific efflue qualities. Depending on the desired effluent quali and the characteristics of the waste water o process combination will prove the most econom cal. A treatment process sequence was selected f waste waters from the organic chemical indust and for various combinations of domestic and i dustrial waste water. Each treatment sequence w designed for a range of waste characteristics ar treatment parameters and the total plant cost w developed. Cost models were then generated whic described the influence of the various paramete on the total cost. This serves to illustrate the econ my of scale and the significance of the vario parameters on cost. The sensitivity of the capit cost to change in the waste parameters is shown. the development of the cost models wide variatio of design parameters were incorporated. For the i dustrial model BOD was varied from 200 to 3,0 mg/l, suspended solids from 0 to 500 mg/l and from 0.0001 to 0.0007 l/mg per hour. For the con bined treatment model BOD and suspended solic varied from 200 to 800 mg/l and K from 0.0001 0.00013 l/mg per hour. (Hancuff-Texas)
W70-09938

MARINE WASTE DISPOSAL IN GHAN WATER QUALITY EVALUATION,
University of Science and Technology, Kuma (Ghana).
C. K. Annan, and A. M. Wright.
Fifth International Water Pollution Research Co ference, San Francisco, July 26-August 1, 197 Preprint. 7 p, 2 fig, 2 tab, 9 ref.

Descriptors: *Sewage, *Monitering, *Water qual ty, *Evaluation, Chemical properties, Biologic properties, Physical properties, Bacteria, Sewag treatment, Analysis.
Identifiers: *Marine disposal, Ghana.

Special studies on the aspects of water quality wer made to plan the most appropriate marine was disposal system which would provide adequate pr tection for the beneficial uses of the coastal wate The significant findings of this study were as fo lows: (1) the strength of the sewage from th Accra-Tema Metropolitan Area is expected to b medium strength, that is, a BOD of 280 mg/l an total suspended solids of 219 mg/l. (2) The greas content of the sewage is expected to be relativel high in comparison with urban wastes of the Unite States, i.e. 110 mg/l. (3) the bacterial dieaway rat in the receiving waters is high (T sub 90 of 8 minutes). (4) strong Guinea currents exist on th coast. These currents are predominately parallel t the shore line, (5) except in areas of direct pollu tion the beach waters in the study area were foun to be relatively free of coliform organisms. It is ar ticipated that the strong Guinea currents woul transport the wastes away from the discharge loca tions generally parallel to the shore line. This facto

coupled with the high coliform bacteria die-off rate implied that appropriately treated sewage could be discharged safely through a well designed marine outfall system. (Hancuff-Texas)
W70-09939

PROPOSED PLANS FOR SEWAGE DISCHARGE FROM THE GOTHENBERG REGION, SWEDEN,
Goteborg Water and Sewage Authority (Sweden).
E. Rindergard, and S. Hallquist.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 8 p, 3 fig, 2 tab.

Descriptors: *Sewage disposal, *Sewage treatment, *Planning, Waste water treatment, Alternative costs, Water pollution, Costs.
Identifiers: *Gothenburg (Sweden), Outfall, Study.

Gothenburg is the second city of Sweden and is situated on its western coast. Its population is now about 450,000, and it is estimated the total population will be 750,000 in the year 2000. The river Gota Alv flows through Gothenburg. The main pollutant in the river are (1) suspended solids, 50,000 tons/yr inorganic (clay) and 20,000 tons/yr organic matter (2) industrial waste mainly from paper mills but also from metal and chemical factories, and (3) bacteria. There are no problems affecting the dissolved oxygen and BOD of the river water. The amount of suspended solids in the sewage from the city is equivilant to roughly 10,000 tons/yr. The equivilant of about 400 tons/yr of P enters the river with the sewage and increases the P content to approximately 0.06 ppm. The proposed sewerage system consists of construction of intercepting pipelines and rock tunnels by which all sewage from the city can be conveyed to a site where a treatment plant is to be built. After treatment the sewage could be discharged either into the mouth of the river or into the sea beyond an archipelago which lies just off of the coast. In order to compare conditions at alternative points an extensive investigation has been undertaken. Discharges of the sewage into the sea outside the archipelago, whether after primary treatment alone or with high rate biological treatment, seems to offer an acceptable solution. (Hancuff-Texas)
W70-09942

REMOVAL OF FLUORINE AND ARSENIC FROM THE WASTE WATER OF THE RARE-EARTH INDUSTRY,
State Research Inst. for Rare Metals, Moscow (USSR).
T. Skripach, V. Kagan, M. Romanov, L. Kamen, and A. Semina.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 7 p, 12 fig, 1 tab.

Descriptors: *Fluoride, *Arsenic compound, *Waste water treatment, *Industrial wastes, Iron, Chemical precipitation, Efficiency, Mixing, Flocculation, Sedimentation, Oxidation.
Identifiers: *Rare-Earth metals, Agitation.

The removal of fluorine from industrial waste waters is accomplished through the use of calcium oxide. The reagent consumption was 200% of the amount required stoichiometrically. The agitation time required without heating is 45 minutes. Results show the fluorine content of the purified water is from 15 to 20 mg/l. Final polishing for the removal of small amounts of fluorine should be made with super phosphate and calcium oxide, or aluminum sulfide. The feasibility of using ion exchange resins and membranes for the removal of fluorine has been shown. The removal of arsenic from industrial waste waters can also be effected with calcium oxide. Iron must be present in an amount which assures total removal of arsenic compounds. If iron salts are not present a special treatment process is required and the description of the treatment is presented. (Hancuff-Texas)
W70-09943

POLYMER PARTICLE REMOVAL FROM LIQUID EFFLUENTS,
V. A. Prokhorova.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 7 p, 2 fig, 5 tab, 12 ref.

Descriptors: *Effluents, *Coagulation, Chemical precipitation, Colloids, Stabilization, Waste water treatment, Biological treatment.
Identifiers: *Polymers, *Particles, *Removals, Chemical composition.

Suspension, polymerization and copolymerization of styrene using a stabilizer, a suspension of polyvinyl alcohol containing 10 to 21% acetate groups, yields liquid effluents which are stable colloidal systems from the point of view of sedimentation and aggregation and which cannot be treated biologically without pre-treatment. The precipitation and coagulation treatment for the removal of polyvinyl alcohol was studied using alum and magnesium chloride. The results show that magnesium chloride coagulation was much more advantangeous. The following would be essential advantages over the commonly used alum: (1) coagulant consumption is reduced 6 to 7 times, (2) caustic soda consumptions is reduced 2 to 3 times, (3) volume precipated is reduced 5 to 7 times, and (4) the rate of precitation of suspended matter is increased 22 times. The experiments also showed that the pretreated effluents can be treated biologically without dilution. Chemical oxygen demand after chemical treatment ranged from 470 to 2,200 mg/l. Biological oxygen demand after biological treatment was 14 mg/l. As a result of biological treatment the effluents lost their specific sharp odor. (Hancuff-Texas)
W70-09945

APPLIED RESEARCH ON MARINE SEWAGE DISPOSAL FROM THE GOTHENBURG REGION, SWEDEN,
Stockholm Univ. (Sweden). International Meteorological Inst.
For primary bibliographic entry see Field 05B.
W70-09947

BIOLOGICAL FILTERS, (LITERATURE REVIEW),
R. L. Bunch.
Journal Water Pollution Control Federation, Vol 42, No 6, p 895-897, June 1970, 24 ref.

Descriptors: *Trickling filter, *Biological treatment, *Waste water treatment, Filters, Filtration, Costs, Operations, Design, Sewage treatment, Mathematical model, Nutrients.
Identifiers: Variables.

A review of the 1969 literature on biological treatment through the use of trickling filters is presented. A variety of studies have been made on the design, mathematical modeling, industrial applications, and dynamic optimization of these filters. Several studies were performed on evaluating media and the effect of recirculation on efficiency. A large number of cost analyses were made; one summarizes the findings from 1500 waste water treatment plants. Two studies relating to nutrient removal were reported. Because the rotating biological discs method of treating wastes is related to trickling filters it was included in this topic. The variables investigated were hydraulic loading, organic loading, disc speed rotation and dissolved oxygen content of the mixed liquor. (Hancuff-Texas)
W70-09948

OXIDATION OF AQUEOUS SULFIDE BY O2: I. GENERAL CHARACTERISTICS AND CATALYTIC INFLUENCES,
Harvard Univ., Cambridge, Mass.
K. Y. Chen, and J. C. Morris.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 17 p, 12 fig, 1 tab, 15 ref.

Descriptors: *Oxidation, *Sulfides, *Oxygen, *Catalysts, Alkaline waters, Test procedures, Hydrogen, Ion concentration, Kinetics.
Identifiers: Stoichiometry, Experiments.

This survey of kinetic patterns and external influences in the oxidation of aqueous sulfide by oxygen has served primarily to show the extreme complexity of the oxidation and the numerous types of outside factors that can speed up or retard the rate. The variation of the initial rate of reaction with respect to sulfide were conducted varying the sulfide concentration and the oxygen concentration. The influences of pH on the reaction rate are also discussed. No definitive or even tentative mechanism can be proposed on the basis of the current results but the data do provide a basis for the kind of detailed experimentation needed to develop a reasonable mechanism. That the reaction as a chain has been shown rather definitely. The problem now is to find the chain carriers and the pathway of their reactions. From a practical point of view the general data indicate that in some circumstances sulfide and oxygen may coexist in aqueous solution for quite long periods of time. On the other hand the effects of metal ions in various types of organic compounds indicate that it will be difficult or impossible to predict a lifetime of sulfide in any given natural water even in the absence of biological effects. The catalytic effects of metal ions may however provide a means for speeding up the oxidation circumstances where it is desirable. (Hancuff-Texas)
W70-09949

VOLATILIZATION AND NITRIFICATION OF NITROGEN FROM URINE UNDER SIMULATED CATTLE FEED LOT CONDITIONS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
B. A. Stewart.
Environmental Science and Technology, Vol 5, No 7, p 579-582, July 1970. 1 fig, 7 tab, 7 ref.

Descriptors: *Nitrification, *Cattle, *Soils, Ammonia, Nitrogen Moisture content, Depth, Chemical oxygen demand, Farm wastes, Urine.
Identifiers: *Feed lots.

Virtually all the recent growth in cattle feeding has been in feeding units of 10,000 head or more in which cattle are confined in pens allowing 6 to 20 sq meters per animal. Animal wastes resulting from these large feeding operations cause concern in many areas. Disposal of the accumulation of solids wastes is difficult and in some cases run-off from these lots has caused pollution of streams and lakes. Feeding operations can cause high nitrogen concentrations in the underground water supply. There are large differences in the amount of nitrate found under feed lots: some contain large amounts, other nearly nitrate free, both at shallow and deep depth. The objectives were to simulate some feed lot conditions and study the nitrification and volatilization weights of nitrogen added as cattle urine to soil in an attempt to determine some of the factors governing nitrate accumulation under feed lots. Urine accounts for about half of the nitrogen excreted by cattle. When urine was added every two days to an initial wet soil at a rate of 5 ml per 21 cm sq, less than 25% of the nitrogen was lost as ammonia and about 65% converted to nitrate. When urine was added every 4 days to initially dry soil, essentially all the water evaporated between the urine additions, and 90% of the nitrogen was lost as ammonia. These findings suggest that the stocking rate and other management factors should be considered in pollution of the unit. (Hancuff-Texas)
W70-10023

COMPUTER DESIGN OF CMAS SYSTEMS,
Kansas Univ., Lawrence.
Daniel W. Smith.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA4, p 977-990, August 1970. 7 fig, 4 tab, 11 ref.

Descriptors: *Computers, *Computer programs, *Activated sludge, *Mathematical model, Waste water treatment, Sewage treatment, Design, Mixing, Cost, Optimization.
Identifiers: *Complete mixing conditions, Suspended solids, CMAS.

The complete mixing activated sludge (CMAS) model combined with cost information to allow selection of the most economical unit based on construction cost and operating conditions is developed into a computer designed program. The procedure followed is first to select a sludge age and aeration tank size and then solve the complete mixing activated sludge equations for each set of input data. The aeration tank size and sludge age values are incremented the desired number of times and amount with the calculations repeated each time. The cost of the secondary system is determined once for each aeration tank size and stored by the computer. The average unit BOD5 removal cost and average unit suspended solids removal cost are determined for each tank size. At each sludge age the aeration tank with the lowest unit BOD5 removal cost meeting the operational limits is selected. The processor time required for the actual execution of the program is 0.504 minutes based on a run using 15 sets of data 10 tank sizes, and 10 sludge age values. The cost of computer and related systems time and for the printing of the output is approximately $2.65. (Hancuff-Texas)
W70-10024

ANAEROBIC PROCESSES (LITERATURE REVIEW),
S. Ghosh, and F. G. Pohland.
Journal Water Pollution Control Federation, Vol 42, No 6, p 920, 934, June 1970. 99 ref.

Descriptors: *Anaerobic digestion, *Sludge treatment, *Digestion, Waste water treatment, Sewage treatment, Microbiology, Kinetics, Control, Organic loading, Efficiencies, Performance.
Identifiers: Applications.

A review of the 1969 literature on anaerobic processes is presented. Microbiology of anaerobic digestion is characterized by several authors in terms of the predominant species. A wide variety of substrates, intermediate products and end products are presented for the digestion process. There is an increased interest by researchers in developing rock filled upflow-type anaerobic filters. The loadings, efficiencies, and design parameters of this type filter are enumerated. Use of anaerobic denitrification is evaluated by several authors. The feasibility of treating dilute wastes under anaerobic conditions was investigated and a great deal of data is presented on loadings, efficiencies, sludge concentration, temperature influences and gas production. The advantages of multi stage anaerobic processes are elaborated. The effects of various parameters such as temperature, pH, electrode potential, and loading were reported. Many studies were made on the kinetics of digestion attempts were made at developing inhibition functions which reflected the growth limiting characteristics. Several methods were suggested for digester control, the oxidation reduction potential in combination with the pH being the most intensely discussed. Some applications of digestion were the digestion of carbohydrates, spent sulfide liquor, cane sugar, factory waste water, molasses decomposition distillary waste water and waste water from glycerol production. (Hancuff-Texas)
W70-10025

MIXED LIQUOR SOLIDS SEPARATION BY FLOTATION,
Federal Water Quality Administration, Washington, D.C.
Michael C. Mulbarger, and Donald D. Huffman.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA 4, p 861-870, August 1970. 5 fig, 3 tab, 9 ref.

Descriptors: *Activated sludge, *Aeration, Waste water treatment, Performance, Design, Cost, Sludge, Suspended load, Sedimentation.
Identifiers: *Flotation, *Suspended solids, Loading, Thickening.

A full-scale dissolved air flotation unit designed for solids-liquid separation of an activated sludge mixed liquor was evaluated in a field investigation. The data indicated that conventional design parameters do not adequately predict flotation performance in terms of effluent suspended solids. A new parameter was developed and is proposed a rational design guideline. Conventional design criteria such as the solids loading rate and air solids ratio did not describe flotation performance in terms of the effluent suspended solids. A cost-quality comparison of flotation versus gravity sedimentation with waste sludge thickening indicated that overall planning and performance could have been improved for a substantial economic savings. A savings in tankage volume and area requirements would have resulted from the use of a conventional gravity clarifier with or without waste sludge thickening. If gravity sedimentation had been used, the total costs indicated that the expenditures associated with mixed-liquor solid separation would have been approximately 30% of the flotation costs. As compared to the use of a flotation unit alone, the combination of gravity sedimentation and waste sludge thickening by flotation would have produced a savings of about 48% ($0.03 per thousand gallons). (Hancuff-Texas)
W70-10026

SEWAGE TREATMENT SYSTEM ODORS AND AIR POLLUTANTS,
Stone (Ralph) and Co., Los Angeles, Calif.
Ralph Stone.
Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 96, No SA 4, p 905-909, August 1970. 3 tab.

Descriptors: *Odor, *Sewage treatment, *Air pollution, *Sewage, Waste water treatment, Aeration, Sludge, Chemicals, Incineration, Sewers, Costs, Activated sludge, Oxidation.
Identifiers: *Odor control, Threshold number, Sewer maintainance, Air pollution control.

The major pollution problem associated with sewerage systems is odor. Sludge or screening incinerators may discharge particulate matter, incompletely combusted or organic compounds and sulfur dioxides all of which are air pollutants. The intensity of sewage odor production is dependent upon the following factors: organic concentration, temperature, sulfate content, detention time, aggetation, microbes, pH, and flow depth. Methods of odor control are: (1) preventing the odors from forming, (2) preventing the odors from reaching the atmosphere, and (3) removing or renovating the odors which have been formed. Odors may be suppressed by: (1) sewer maintainence to remove biological slimes, grease, and silt; (2) addition of oxidation or reduction compound; (3) precipitation of sulfides; (4) waste pretreatment to reduce waste strength; and (5) the use of perfume masking agents. Odors can be prevented from reaching the atmosphere by sealing enclosures and collecting by partial vacuum within the disposal facility. The odors and air pollutants such as particulate matter and nitrogen oxides can be reduced by appropriate afterburners, scrubbers, activated carbon, or other specialized equipment. (Hancuff-Texas)
W70-10027

DETERGENTS (LITERATURE REVIEW),
S. K. Banerji.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 916-920, June 1970. 31 ref.

Descriptors: *Detergents, *Alkylbenzene sulfonates, *Linear alkylate sulfonates, Digestion, Waste water treatment, Sewage treatment, Phosphates, Biodegradation, Degradation (Decomposition), Surfactants.
Identifiers: Methylene-Blue Active Substance.

A review of the 1969 literature on detergents is presented. A European council proposed a ban on detergents which were not 80% biodegradable. A report on the reduction of Methylene-Blue Active Substance in the Illinois river shows a drop from 0.54 mg/l in 1959 to about 0.05 mg/l in 1965. Several studies of the toxic effects of detergents on fish and the synergistic effects when combined with various insecticides is discussed. The mechanisms of detergent biodegradation and biodegradability is reported on by several authors. The role of algae in degrading surfactants is also discussed. A situation regarding anionic detergent toxicity to anaerobic digestion in the United Kingdom is reviewed. The processes for the removal of detergents from waters is included and efficiencies of various methods reported. The role of phosphates as a detergent builder and its eutrification implications are discussed. Boron salts an ingredient of detergents were found to be toxic to laboratory activated sludge units in concentrations greater than 10 mg/l. Environmental effects of the enzymes present in detergents seem to be of some concern. The enzymes were not present in the effluent of conventional waste water treatment plants and were nontoxic to rats at a dosage 10 grams per kg. (Hancuff-Texas)
W70-10028

CHEMICALS, BUGS TAME PROCESS WASTES.

Environmental Science and Technology, Vol 4, No 8, p 637-638, August 1970. 2 fig.

Descriptors: *Industrial wastes, *Waste water treatment, *Activated sludge, Biological treatment, Coagulation, Nutrients, Lagoon, Sludge, New Jersey.
Identifiers: *Polyvinyl chloride, Polyelectrolytes, Pedricktown (New Jersey).

A combination of coagulation and activated sludge treatment is being used by B. F. Goodrich Chemical Company for the treatment of a polyvinyl chloride waste. The waste is milky white and contains various amounts of monomers, polymers, dispersants, organic and inorganic salts, etc., in both suspended and dissolved forms. The one million dollar plant is based on design criteria of 90% reduction of ultimate BOD and flow of 800,000 gallons per day. The primary treatment consists of the addition of coagulant and coagulant aid in two compartment mixing tanks. Ferric chloride is used as a coagulant at a dosage of 150 ppm. Secondary treatment consists of an activated sludge process to which small amounts of nutrients, nitrogen and phosphorus must be added. Caustic soda is also added just prior to the aeration tank to keep the pH above 7. The effluent is then fed to a tertiary lagoon. The settled sludge from both chemical sludge and biological sludge thickners is centrifuged and dewatered to about 40 to 50% solids. The dewatered sludge is inert and trucked to land fill. Goodrich aims at eventually 100% reuse of its water supply but further treatment of the lagoon effluent will be necessary. (Hancuff-Texas)
W70-10030

LAGOONS AND OXIDATION PONDS (Literature Review),
W. C. Boyle.
Journal of the Water Pollution Control Federation, Vol 42, No 6, p 910-916, June 1970. 39 ref.

Descriptors: *Waste water treatment, *Lagoons, *Ponds, Oxidation, Biological treatment, Sewage treatment, Aeration, Temperature, Industrial wastes, Nutrients, Coliform, Efficiency, Poultry, Tertiary treatment.

A review of the 1969 literature on lagoons and oxidation ponds is presented. The review includes discussion of principles of aerated lagoon design. A pilot plant study to treat box-board white water and paper-board mill waste waters is outlined. Discus-

sion of several full scale aerated lagoons is presented and includes the design and cost of treatment. A variety of industrial wastes are treated through pond and lagoons: Kraft mill wastes, pulp and paper mill wastes, refinery and chemical wastes, poultry wastes, hog slaughter house wastes, animal wastes, dairy manure wastes and phenolic wastes. Data are presented on the design, power requirements, organic loadings, efficiencies, effects of temperature, aeration requirements, nutrient requirements, coliform and pathogen removals, and influence of detergents. The use of ponds as tertiary process is also discussed for a variety of wastewaters. (Hancuff-Texas)
W70-10031

FWQA STEPS UP TERTIARY TREATMENT STUDY.
Environmental Science and Technology, Vol 4, No 7, p 550-551, July 1970. 4 fig.

Descriptors: *Tertiary treatment, *Nutrients, Nitrogen phosphorus, Nitrification, Denitrification, Waste water treatment, Biological treatment, Sewage treatment, Chemical precipitation, Pilot plants.
Identifiers: FWQA.

A general description is given of four processes currently being studied at the Advanced Waste Treatment facilities of the FWQA in Washington, D. C. All of the treatment sequences under investigation include processes that have as yet found little or no use in municipal waste water treatment. Three of the sequences include conventional primary treatment and secondary biological processes followed by tertiary nutrient removal steps. Another and independent physical-chemical system relies primarily on non-biological means of organic and nutrient removal. The main features of the treatment sequence which qualify them as advanced waste treatment are the capabilities for phosphate and nitrogen nutrient removal. Two alternative approaches are discussed in regard to the removal of nitrogen: physical-chemical and biological. Physical-chemical treatment is effected through pH adjustment. The pH is increased and the nitrogen stripped as ammonia. The second uses biological treatment to convert the nitrogen from the ammonia form to the nitrate form through nitrification and this is followed by biological denitrification, an anaerobic bacterial process. The independent physical-chemical treatment bypasses the conventional primary and secondary treatment steps; instead the incoming waste water is treated with lime in the two stage clarification process. The effluent from the phosphate removal step is treated in carbon adsorption columns and undergoes physical-chemical nitrogen removal. (Hancuff-Texas)
W70-10032

ARMCO STEEL FACILITY FEATURES POLLUTION CONTROL,
Armco Steel Corporation, Middletown, Ohio.
C. G. Kramer.
Civil Engineering, Vol 40, No 6, p 37-40, June 1970. 4 fig.

Descriptors: *Air pollution, *Waste disposal, *Water reuse, *Concrete construction, Waste water treatment, Industrial wastes, Deep wells, Water pollution control, Soils, Foundations, Groundwater, Ohio.
Identifiers: Middletown (Ohio).

Armco's new Middletown works has been named the outstanding engineering achievement of 1970. Perhaps the most significant aspect of the project is the attention and effort devoted to environmental quality. Altogether 14 separate air and water pollution control systems were planned and developed at a capital cost of nearly $39,000,000. Operation, maintenance and material cost for these systems will be about $4,000,000 per year. At the basic oxygen furnace, a Japanese 'off-gas' system was introduced to the U.S.; by treating dirty carbon monoxide gas before it is oxidized the volume of gases to be treated is reduced 75%, and the size of the gas cooling system is reduced 90%. The plant disposes of its acid wastes by deep well injection. Disposal of the pickle wastes in this way is considered to be both effective and safe. A 100,000 gallon per minute water treatment plant is employed to permit recycling of the water from hot rolling mills. The treatment consists of dosing the ferric sulfate and lime in the flash mix tanks. Additon of coagulant aids in the flocculation tanks is followed by clarification. To date the waste system meets all the objectives, for example, the intake stream has a 171 ppm suspended solids and the water discharge 8 ppm suspended solids. Also featured are imaginative designs in concrete specifications, piles, and strip-mill basements. (Hancuff-Texas)
W70-10033

5E. Ultimate Disposal of Wastes

WASTE DISPOSAL AND EARTHQUAKES AT THE ROCKY MOUNTAIN ARSENAL, DERBY, COLORADO,
Geological Survey, Washington, D.C.
H. K. Van Poolleen, and D. B. Hoover.
Journal of Petroleum Technology, p 983-993, August 1970. 11 p, 11 fig, 3 tab, 32 ref.

Descriptors: *Injection wells, *Earthquakes, *Colorado, Waste disposal, Faults (Geology), Crystalline rocks, Metamorphic rocks, Transmissivity, Porosity, Injection, Safety, Fractures (Geology).
Identifiers: Rocky Mountain Arsenal (Colo), Denver (Colo), Hubbert-Rubey theory, Waste disposal wells.

In early 1962 waste water was injected into a 12,000-ft well drilled in the pre-Cambrian near Denver, Colo. Since that time over 100 earthquakes large enough to be felt have occurred in this area where no quakes had been recorded before (one as high as Richter magnitude 5.3). In 1966 water injection was stopped, but earthquake activity has continued. Several mechanisms explain this phenomenon--the Hubbert-Rubey theory, reduction of coefficient of friction, hydraulic fracturing, and thermal and chemical effects. (Knapp-USGS)
W70-09539

UNDERGROUND WASTE DISPOSAL,
Gurnham and Associates, Inc., Chicago, Ill.
Charles A. Caswell.
Environmental Science and Technology, Vol 4, No 8, p 642-647, August 1970. 6 p, 5 fig.

Descriptors: *Injection wells, Hydrogeology, Waste disposal, Legal aspects, Safety, Environmental engineering.

The technology, hydrology, and legal status of deep disposal wells are briefly reviewed. Injection is ultimate disposal in the sense that wastes are held out of contact with the surface environment for a very long time, long enough to render many wastes harmless by geochemical processes before they reach the surface again. In many cases wastes are made safe enough that underground disposal is a valuable source of aquifer recharge. In many cases, however, injection is not feasible because wastes are too long-lived or the hydrogeology of the disposal horizon is not favorable for safety, long retention, or degradation of the wastes. Legal problems include underground trespass, liability for damage, and ownership of aquifers and groundwater. (Knapp-USGS)
W70-09543

SOME CONSIDERATIONS IN UNDERGROUND WASTE WATER DISPOSAL,
Ohio River Valley Water Sanitation Commission, Cincinnati; and Missouri Univ., Columbia. Dept. of Geological Engineering.
Edward J. Cleary, and Don L. Warner.
Journal American Water Works Association, Vol 62, No 8, p 489-498, August 1970. 10 p, 16 ref.

Descriptors: *Injection wells, *Waste water disposal, *Ohio River, *Industrial wastes, *Regulation, Water law, Monitoring, Hydrogeology, Legislation, Injection, Water wells, Water rights, Reviews, Publications.
Identifiers: Ohio River Basin, Orsanco, Waste disposal wells.

Two sections of a monograph on underground waste water disposal are presented and the entire monograph is briefly discussed. The monograph provides perspective on the status of underground injection practice and the social concerns and policy issues that relate to it, and offers regulatory guidelines and criteria for evaluating the location, design construction, and operation of injection wells, specifically with respect to geological and other circumstances in the Ohio Valley. Legal liabilities and constraints are more important than technical ones. All aspects of the planning, constuction, operation, and abandonment of waste-injection systems should be embraced in the regulatory process. Although only small areas of the Ohio Valley are limited for waste injection on the basis of hydrologic consideration of the rock units, geologic structure, and groundwater circumstances, only limited quantities of wastes should be regarded as eligible for subsurface disposal. Continuous records of waste water volumes and injection pressures should be kept. Monitoring of conditions at the injection interval or other intervals above or below the injection horizon is often desirable. (Knapp-USGS)
W70-09549

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES,
Alabama Univ., University, Natural Resources Center.
David M. Grubbs, Charles D. Haynes, and William E. Tucker.
Available from NTIS as PB-194 112, $3.00 in paper copy, $0.65 in microfiche. Alabama University Natural Resources Center, and Alabama Geological Survey Report, May 1970. 85 p, 23 fig, 2 tab, 42 ref. OWRR Project No B-019-ALA (2).

Descriptors: *Waste water disposal, *Injection wells, *Alabama, Aquifers, Aquicludes, Hydrogeology, Water law, Legal aspects, Groundwater movement, Permeability, Cost analysis, Water costs, Computer programs, Water conservation.
Identifiers: Waste injection wells.

Geological and engineering parameters which govern the disposal of liquid-waste material by deep-well injection were evaluated in Alabama. A study was made of geology to identify potentially favorable subsurface reservoirs. Physical properties controlling fluid movement and storage, and liquid wastes from industries were injected into core samples of actual reservoir rocks. Parameters required for confinement of wastes to assure the isolation of fresh water and other natural resources from adverse effects of waste injection were studied. A design and cost procedure was supplemented by a computer program to provide rapid feasibility studies. Data provided by wells drilled for oil and gas show several potential receptive horizons in the southwest portion of the state near Mobile. Until definition of legal responsibilities is clarified, disposal of liquid wastes in deep-wells should be undertaken only after study of capacity, permeability, confining beds, and control of the flow stream. Aspecial bibliography is included containing 460 entries. (Knapp-USGS)
W70-09771

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX A: DESIGN AND

COST OF LIQUID-WASTE DISPOSAL SYSTEMS,
Alabama Univ., University, Natural Resources Center.
Charles D. Haynes, and David M. Grubbs.
Available from NTIS as PB-194 113, $3.00 in paper copy, $0.65 in microfiche. Alabama University, Natural Resources Center, and Alabama Geological Survey Report, May 1970. 120 p, 36 fig, 2 tab, 21 ref, append. OWRR Project B-19-ALA (3).

Descriptors: *Waste water disposal, *Cost analysis, *Computer programs, *Alabama, Construction costs, Maintenance costs, Capital costs, Design, Aquifers, Hydrogeology, Water conservation.
Identifiers: Waste disposal wells.

Elements of the cost of waste water injection wells include capital outlay, maintenance, and operation. Design is critical to initial capital investment and is a contributing factor in other cost elements. The computer-derived cost of deep-well disposal systems is tempered to meet the physical parameters dictated by the geology of Alabama. An objective of the study is to conserve the fresh-water resource of the State if feasibility of this method of waste disposal can be established. Variable site cost factors include depth of the well, physical properties of the receptive horizon, mechanical limitations of the well design and equipment, and also management decisions with reference to investment in the disposal well and its components related to waste volume and alternate or stand-by disposal means. A computer program affords a flexible procedure for design and estimation of costs of deep-well disposal systems. Although the program is keyed to costs dictated by the geology of Alabama, it is applicable to any area by modification of tables pertaining to drilling costs. (Knapp-USGS)
W70-09772

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX B: PART I CHEMICAL REACTIONS BETWEEN ACID INDUSTRIAL WASTES, FORMATION WATERS, AND MINERALS IN SALAQUIFERS OF ALABAMA; PART II, LABORATORY STUDY OF SELECTED RESERVOIR ROCKS,
Alabama Univ., University. Natural Resources Center.
David M. Grubbs, and Travis H. Hughes.
Available from NTIS as PB-194 114, $3.00 in paper copy, $0.65 in microfiche. Alabama University, Natural Resources Center, and Alabama Geological Survey Report, May 1970. 23 p, 3 fig, 5 tab, 11 ref. OWRR Project B-019-ALA (4).

Descriptors: *Water chemistry, *Waste water disposal, *Injection wells, *Alabama, Laboratory tests, Hydrogeology, Porosity, Permeability, Chemical reactions, Chemical precipitation.
Identifiers: Waste disposal wells.

Although the important chemical reactions in waste injection may be predicted, the physical effects of these reactions often are not predictable. Laboratory studies of a variety of reservoir rocks samples were conducted in an effort to establish storage capacity and flow parameters and to assess compatibility of potential receptive horizons with injected liquid wastes. Groundwater reservoirs with physical and chemical parameters favorable to injection of liquid wastes are at moderate depths in the geologic sections in a portion of Alabama. There should be no significant permanent reduction in porosity as a result of injection of sizable volumes of most of the State's industrial wastes. Permeability to continued flow of waste material showed a substantial decrease after a period of relatively few days, but could be restored to a level satisfactory for injection by flushing the aquifer with water. Permeability loss resulting in reduction of injection rates is greatest at the well face. Remedial action may be taken in some instances to restore flow to a suitable level. (Knapp-USGS)
W70-09773

CONSERVATION OF FRESH-WATER RESOURCES BY DEEP-WELL DISPOSAL OF LIQUID WASTES, APPENDIX C: STRATIGRAPHY OF ALABAMA (WITH A SECTION ON PHYSIOGRAPHY),
Alabama Univ., University. Natural Resources Center.
Donald B. Moore, and James Daniel Moore.
Available from NTIS as PB-194 115, $3.00 in paper copy, $0.65 in microfiche. Alabama University Natural Resources Center, and Alabama Geological Survey Report, May, 1970. 56 p, 4 fig. OWRR Project B-019-ALA (5).

Descriptors: *Stratigraphy, *Geomorphology, Alabama, *Geologic formations, Hydrogeology, Rocks, Geological surveys, Geologic time.

The following stratigraphic features of Alabama are briefly discussed: Paleozoic Rocks; Cambrian System; Ordovician System; Silurian System; Devonian System; Carboniferous System; Mississippian Series; Pennsylvanian Series; South Alabama Stratigraphy (Subsurface); Jurassic System; Cretaceous; Paleocene Series; Eocene Series; and Oligocene Series. Alabama lies partly in the following five physiographic provinces: Highland Rim Section of the Interior Low Plateaus, the Cumbeland Plateau Section of the Appalachian Plateaus, the Valley and Ridge, the Piedmont Upland Section of the Piedmont, and the East Gulf Coastal Plain Section of the Coastal Plain.
W70-09774

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 05D.
W70-09813

DISPOSAL OF INDUSTRIAL SLUDGES,
Institut fuer Wasserwirtschaft, Berlin (East Germany).
For primary bibliographic entry see Field 05D.
W70-09814

ON USING INDUSTRIAL AND DOMESTIC WASTES IN AQUACULTURE,
Maryland Univ., Solomons. Natural Resources Inst.
J. A. Mihursky.
Agricultural Engineering, Vol 50, No 11, p 667-689, 1969. 1 fig, 3 tab, 18 ref.

Descriptors: *Waste disposal, *Aquaculture, *Ultimate disposal, Domestic wastes, Industrial wastes, Sewage wastes, Byproducts, Fertilizers, Algae, Zooplankton, Fish, Shellfish, Steam, Electric power, Heated water, Proteins, Aquatic microorganisms, Temperature, Activated sludge, Fisheries, Carp, Clams, Ponds, Running waters, Fresh water, Brackish water, Economics, Cycling nutrients, Foods.
Identifiers: Petroleum wastes, Mercenaria mercenaria, Aquaculture, Recycling wastes.

Three waste materials have the greatest potential for recycling through aquatic systems into useful nutrients--petroleum wastes, sewage wastes, and waste heat. Protein developed and sold in France is produced by microorganisms growing on waste low-grade petroleum. Large-scale use of microbiologically derived proteins seems possible. Sewage converted to inorganic materials may provide fertilizer for algal production. Waste heat may assist in providing optimal environmental conditions for biological growth at all trophic levels. In various world situations sewage or sewage products are used to stimulate fishery production. Algae grown in mass aided by water from treated sewage and concentrated by evapodrying technique produces food for chickens. Waste heat from steam electric stations is used to raise carp in latitudes farther north than usual and to extend the growing season in some localities. A waste flue gas was used to supply carbon dioxide gas to mass-culture an algal food supply. Wild or natural water is preferable to pond culture. Running water systems permit dense stocking, waste removal and continued dissolved oxygen renewal. Costs of producing fish protein concentrate through aquaculture plus waste utilization will be subsidized by society's need to recycle its waste materials into useful foodstuffs. (Jones-Wisconsin)
W70-09905

SLUDGE TREATMENT DISPOSAL AND UTILIZATION (Literature Review),
For primary bibliographic entry see Field 05D.
W70-09935

LAND SPREADING, A CONSERVING AND NON-POLLUTING METHOD OF DISPOSING OF OILY WASTES,
Federal Water Pollution Control Administration, Cincinnati, Ohio. Ohio Basin Region.
G. K. Dotson, R. B. Dean, W. B. Cooke, and B. A. Kennar.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 15 p, 4 fig, 4 tab, 20 ref.

Descriptors: *Oils, *Oil waste, *Waste water disposal, *Soil microorganisms, Microorganisms, Bacteria, Fungi, Soils, Efficiencies, Laboratory tests, Test procedure.
Identifiers: *Land disposal.

Land spreading is shown to be economical and comparitively fool proof method of disposing of oily wastes. Although large additions of oil may create toxic conditions for plants the eventual effect upon soil is to provide physical and chemical properties by increasing organic matter and nitrogen content, decreasing volume weight and increasing porosity and moisture holding capacity. Soil microbes can oxidize and decompose large quantity of petroleum hydrocarbons under a wide range of soil and environmental conditions. Natural biochemical decomposition of oil in soil may be accellerated by judicious use of lime and fertilizer, artifical drainage and tillage. Microbiological degradegration of oily wastes take place under a wide range of temperature but oxidation is faster in warm or hot climates than in cold. A typical land disposal practice is described for an oil-water separator sludge consisting of an emulsion with about 20% hydrocarbon, 25% solid and 55% water. Various microbiological studies are reported in regard to the number and types of oil decomposing bacteria and fungi. (Hancuff-Texas)
W70-10029

5G. Water Quality Control

REPORT ON THE FEDERAL-STATE-INDUSTRY COOPERATIVE SAVANNAH RIVER WATER QUALITY STUDIES, 1956-1965.
Public Health Service, Atlanta, Ga. Savannah River Advisory Board.

U S Dept of Health, Education and Welfare, Public Health Service Report, November 1967. 173 p, 25 fig, 11 tab, 19 ref.

Descriptors: *Radioactive waste disposal, *Georgia, *Water quality, Radioactive wastes, Path of pollutants, Water chemistry, Monitoring, Sampling, Water quality control.
Identifiers: Savannah River.

From results of the U.S. Public Health Service studies, South Carolina and Georgia surveillance activities, Du Pont monitoring, and other related surveys and investigations, it is concluded that radioactivity releases to the Savannah River from the Savannah River Plant have been maintained well below the established guides and standards for radioactivity in the environment. The low activity levels attained reflect good waste management practices at the plant. The surveillance now being provided is adequate to take care of public health and other interests. The States are continuing their

cooperative program, comparing results with those obtained in Du Pont monitoring program. (Knapp-USGS)
W70-09552

COMBINED SEWER OVERFLOW ABATEMENT TECHNOLOGY.
Federal Water Quality Administration, Washington, D.C.

For sale by Superintendent of Documents, U S Government Printing Office, Washington, D.C. 20402 - Price $2.50. PB-193 939. Microfiche available from NTIS $0.65. Federal Water Quality Administration Water Pollution Control Research Series 11024, Compilation of Papers presented at Symposium on Storm and Combined Sewer Overflows, June 22-23, 1970, Chicago, Ill. 1970. 336 p. FWQA Project 11o24---6/70.

Descriptors: *Water pollution sources, *Water pollution control, *Storm runoff, *Cities, Sewage, Sewers, Waste Water treatment, Sewage treatment, Storm drains, Urbanization.
Identifiers: Combined sewers.

This compilation of papers contains results of the current demonstration grants and contracts that are being supported by the FWQA. The papers discuss: (1) alternatives to storm and combined sewer pollution in a small urban area; (2) screening and air floatation for solids removal; (3) underflow deep tunnel system concept; (4) urban erosion and sediment control; (5) sewer monitoring and remote control; (6) combined sewer overflow regulators; (7) use of fine mesh screens; and (8) land use and urban runoff pollution. (Knapp-USGS)
W70-09558

MATHEMATICAL MODELLING OF WATER QUALITY CHANGES IN A RIVER BASIN,
Hydraulic Research Inst., Brno (Czechoslovakia).
Vladimir Novotny.
Fifth International Water Pollution Research Conference, San Francisco, July 26-Aug 1, 1970, p I-5/1 - I-5/7. 4 fig, 5 ref. Preprint.

Descriptors: *Impaired water quality, *Mathematical models, *Natural streams, *Self-purification, Water temperature, Biochemical oxygen demand, Dissolved oxygen, On-site data collections, Digital computers.
Identifiers: *Non-conservative pollutants, Steady state, Dynamic state.

Problems and design are discussed of a suitable mathematical model which would apply for small and medium streams. Water quality as related to non-conservative pollutants in steady state and dynamic state were discussed and modeled. A river network was divided into sections connected by junction and it was assumed that self-purification processes took place in the sections while waste effluent and tributaries were situated at junctions. The input parameters included water temperature, length of section, approximate function of dependence of detention time in section on discharge, the dependence of average depth on discharge, parameters of limiting concentrations of BOD, COD, etc. The dynamic water quality model is more time consuming and needs of greater computer storage capacity than the steady state model. Observed data are in good agreement with the models. (Hsieh-Vanderbilt)
W70-09593

THE CONTROL OF RIVER HEATING BY ACCURATE DIGITAL SIMULATION,
Motor-Columbus Engineering Co., Baden (Switzerland).
P. Bogh, and H. Zund.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 10-14, 1970, Vol. SM-146, No 45, Preprint. 14 p, 4 fig, 4 ref.

Descriptors: *Thermodynamic behavior, *Nuclear powerplants, *Computer programs, Mixing, Cooling water, Cost-benefit ratio, Cooling towers, Model studies, Velocity, Water temperature, Meteorological data, Air temperature, Heat transfer, Hydraulic systems, Digital computers, Solar radiation, Evaporation, Condensation, Convection.
Identifiers: *Switzerland, River geometry.

The thermodynamic behavior of rivers and river systems was carefully investigated in Switzerland, a country without access to the sea and dependent on river cooling for economic nuclear power generation. To approach the problem, it was decided to prepare a digital simulation to reproduce the thermodynamic behavior of the rivers. The program specially developed for this application allowed for the variation of all basic parameters in such a way that the comparison between measured and computed river temperatures would permit the improvement of the heat transfer coefficients. The program allowed for tributaries with variable temperatures, several different time-varying meteorological conditions along the river, heat sources with time-variable intensity, variable river geometry, and simulation of the dispersion by having two channels with different water velocities. A time interval of just one half an hour in the simulation permitted a close watch on the important daily temperature variations. The results showed the importance of daily temperature variations in adjusting the heat transfer coefficients. (Osborne-Vanderbilt)
W70-09594

THERMAL STANDARDS IN THE UNITED STATES OF AMERICA,
Federal Water Pollution Control Administration, Duluth, Minn. National Water Quality Lab.
D. I. Mount.
Symposium on Environmental Aspects of Nuclear Power Stations, New York, August 10-14, 1970. Vol SM-146, No 15, Preprint, 5 p.

Descriptors: *Temperature control, *Standards, *Water temperature, Seasonal, Monthly, Aquatic life, Interstate rivers, Hypolimnion, Volume, Mixing, Safety, Water cooling, Anaerobic conditions, Algal control, Spawning, Warm-water fish.

Temperature standards specifying permissible water temperatures for interstate rivers and lakes of the United States have been established. Standards for aquatic life must insure a seasonal temperature cycle, and so twelve maximum monthly temperatures are the minimum to describe desired conditions. In streams, a 5F rise may be permitted as long as the resulting temperature does not exceed the appropriate monthly maximum. In lakes, a 3F rise may be used with an additional requirement that the hypolimnion cannot be warmed or changed in volume. Mixing zones pose a difficult regulatory problem. They are difficult to restrict as to size and shape especially because the effects of mixing zones on receiving water depends, in part, on the number of mixing zones and the size of the lake or river. Where cooling devices are required, the standards do not specify the type to be used. The frequency that devices will not meet the standards has not been well defined except in a general way. If no safety margin is permitted, standards must be more complex in order to insure acceptable conditions. (Osborne-Vanderbilt)
W70-09595

DETROIT SEWER MONITORING AND REMOTE CONTROL.
Detroit Metropolitan Water Services, Mich.

In: Combined Sewer Overflow Abatement Technology, A Compilation of Papers Presented at the Federal Water Quality Administration 'Symposium on Storm and Combined Sewer Overflows,' p 219-290, June 22-23, 1970. 33 fig, 4 tab. FWQA Project 11020 FAX.

Descriptors: *Overflow, *Remote control, *Regulated flow, *Sewers, Storm drain, Water pollution control, Flood control, Instrumentation, Computers, Cost, Urbanization.
Identifiers: *Combined sewers, *System monitoring, Storm flow anticipation, First flush interceptor, Selective retention, Selective overflowing.

Detroit is faced with the problem of preventing pollution of the Detroit and Rouge Rivers from its combined sewer system overflows. As an alternative to undertaking a dubiously effective sewer separation program, estimated to cost in excess of two billion dollars, the Detroit Metro Water Department has installed the nucleus of a sewer monitoring and remote control 'System' for controlling the pollution from the combined overflow from many small storms at a cost of slightly over two million dollars. The 'system' includes telemetering rain gages, sewer level sensors, overflow detectors, a centrally located computer and data-logger, and a centrally located operating console for controlling pumping stations and selected regulating gates. Installation has been virtually completed and now enables applying such pollution control techniques as 'storm flow anticipation,' 'first flush interception,' 'selective retention,' and 'selective overflowing.' An evaluation of the effectiveness of this initial installation will serve as the basis for determining what additional pollution control facilities are required, what suburban monitoring and remote control is essential, what computer related equipment for pump and valve control can be used for more effective pollution control, what automatic sampling and analysis will be more valuable in the synchronous operation of the sewerage system and what design parameters should be used in the construction of new or supplemental sewers or treatment facilities. (See also W70-09558). (Marriott-Chicago)
W70-09620

STREAM POLLUTION AND ABATEMENT FROM COMBINED SEWERS BUCYRUS, OHIO,
Burgess and Niple Ltd., Columbus, Ohio.
For primary bibliographic entry see Field 05B.
W70-09621

SAN FRANCISCO BAY IS NOW PRE-SHRUNK,
Thomas H. Harris.
In: All clear, Winter 1969, p 17-20, 3 photo, 1 map.

Descriptors: *Water pollution control, *Water quality control, *Entropy, Inter-agency cooperation, Sewage treatment, Standards, Financing, Attitudes.
Identifiers: *San Francisco Bay, Bay Conservation and Development Commission, Environmental quality.

The once shrinking San Francisco Bay is staging a comeback. Since the initiation of a pollution control program in 1956, $400 million have been spent jointly by the Federal and State governments. Progress has been slow but it can be seen in oil free waters, more abundant fish and shellfish, and in a reduction in the flow of organic material. The San Francisco Regional Water Quality Control Board, chiefly responsible for the program has set new standards for turbidity and discoloration of receiving waters, and limits have been set on thermal pollution from power plants and industrial sources. Planned actions include requirements that all ships and watercraft be equipped with self-contained sewage holding systems and with provisions to connect to dockside receiving tanks. A 30 year, $2 billion, joint collection and tertiary treatment system for the entire Bay Area is also envisioned. The problems are not all solved, however. San Francisco still has an antiquated combined storm drain-sewer, and in many areas sewage is only given primary treatment. Water quality standards are not being met at most discharges and existing standards are also outdated. All of these programs need tremendous public spending in order to be successful. Vocal citizens and conservationists have caused the establishment of a permanent body, the Bay Con-

servation and Development Commission, to legislatively protect the Bay. It remains to be seen whether the public is willing to put their money where their mouths have been. (Marriott-Chicago)
W70-09634

WATER POLLUTION: GREATER CALUMET AREA-INDIANA-ILLINOIS.
League of Women Voters of Chicago, Ill.

League of Women Voters of Chicago, Chicago, April, 1966. 16 p, 35 ref, 2 fig (Mimeographed).

Descriptors: *Pollution abatement, *Illinois, *Indiana, *Pollutant identification, *Water users, *Industrial wastes, Sewage, Waste treatment, Federal Water Pollution Control Act.
Identifiers: *Greater Calumet Area, *Metropolitan Sanitary District of Greater Chicago, *Public Health Service, *Federal Water Enforcement Conference, Thomas J. O'Brien Locks, Calumet River, Water quality criteria, Lake Michigan Basin, Illinois River Basin.

The water pollution problems of the Great Calumet Area are reviewed utilizing resource material, a summary of a U.S. Public Health Service Report (Dec. 1964) and a resume of the 1965-66 Federal Water Enforcement Conference held in Chicago. The Greater Calumet Area is defined, and definitions of pollution are given for the area within the Metropolitan Sanitary District of Greater Chicago and for the remainder of Illinois. While there is no specific federal statute that defines pollution, Congress has legislative authority, and the Federal Water Pollution Control Act gives the federal government responsibility for control and prevention. Findings and conclusions of the U.S. Public Health Report are reviewed. With regard to water users, facts are included concerning municipal water supply, industrial water supply, waste disposal and assimilation, waterborne commerce, recreation, and aesthetics. Industrial and sewage wastes are concluded to be principal pollutants although others are mentioned as significant at times. Findings regarding the percentage of each in the Illinois River Basin and the Lake Michigan Basin are listed. The purpose, legal basis, and conferees at the Federal Enforcement Conference held in March 1965 at Chicago are mentioned. Review is included of testimony from federal, state and MSD representatives. Interstate abatement efforts are agreed to be inadequate and eight standards for immediate remedial action recommended. Included are evaluation of water quality criteria, necessity of at least secondary treatment, minimization of industrial discharges, development of time schedules for constructing waste treatment facilities, sampling of industrial effluent, closing of Thomas J. O'Brien locks on the Calumet River and surveillance of the recommendations by conferees. (Preckwinkle-Chicago)
W70-09647

OPTIMAL TAXING FOR THE ABATEMENT OF WATER POLLUTION,
Cornell Univ., Ithaca, N.Y.
Jerome E. Hass.
Water Resources Research Vol 6, No 2, p 353-365, April 1970.

Descriptors: *Water pollution, *Taxes, *Water quality, *Economic evaluation, Planning, Optimization, Cost, Treatment costs, River basin, Waste disposal, Dissolved oxygen, Management, Income, Mathematical studies, Model studies, Organic waste, Streamflow, Flow rate, Rivers, Total cost
Identifiers: *Dantzig-Wolfe algorithm, *Miami River, *Externalities, Income redistribution.

This paper is concerned with the use of taxes to internalize the costs of pollution. The analysis considers the role of a central authority and provides justification for the imposition of pollution taxes to elicit optimal treatment behavior from each polluter within a basin. The author then derives a rudimentary river basin model that incorporates the fundamental hydrological characteristics of the basin, the imposition of dissolved oxygen standards, and the effects of treatment of organic waste and low flow augmentation on the dissolved oxygen content of a river. This is a mathematical programming model which must be solved by the central authority. The analysis further demonstrates how the Dantzig-Wolfe non-linear decomposition algorithm can be used to achieve the standards imposed at minimum cost to society and to determine the tax structure required to achieve this solution. (Murphy-Rutgers)
W70-09652

DEVELOPING A HYDRO-QUALITY SIMULATION MODEL,
Utah Water Research Lab., Logan.
Neal P. Dixon, David W. Hendricks, A. Leon Huber, and Jay M. Bagley.
Available from NTIS as PB-194 065, $3.00 in paper copy, $0.65 in microfiche. Utah Water Research Laboratory Report PRWG67-1, June 1970. 87 p, 58 fig, 20 tab, 77 ref, 8 append. FWPCA Project 16090 DWR---6/70.

Descriptors: *Systems analysis, *Simulation analysis, *Model studies, *Water quality, *Reservoirs, River basins, Dissolved oxygen, Biochemical oxygen demand, Conductivity, Water temperature.
Identifiers: *Computer requirements, *Program options, *Utah State University.

The development of a river basin simulation model comprising dissolved oxygen, temperature, specific electrical conductance, and basin hydrology submodels is demonstrated. The system model is the device for studying practical questions involving some measure of efficiency - whether this be pollution minimization by treatment and flow regulation, maximizing water use with the quality constraint, maximizing economy efficiency, or in developing more comprehensive water laws. These questions can be ascertained by simulation of altered conditions, sensitivity analysis, or some optimization technique. Although the model in this report was developed for a specific prototype system, the Little Bear River in Utah, the approach, the methods and the conceptual framework can be transferable to other systems. (Woodard-USGS)
W70-09740

RAPID-FLOW FILTER FOR SEWER OVERFLOWS.
Rand Development Corp., Cleveland, Ohio.

Available from NTIS as PB-194 032, $3.00 in paper copy, $0.65 in microfiche. Federal Water Pollution Control Administration Research Series, August 1969. 82 p, 10 fig, 12 tab, 4 ref. append.

Descriptors: *Storm drains, *Sewers, *Overflow, *Solid wastes, *Filters, Research and development, Model studies, Storm runoff.
Identifiers: *Rapid-flow filter, *Combined sewer overflows, Suspended solids, Settleable solids.

In a pilot installation up to about 65% of solids from overflows of combined sewer systems were removed by using lump coal as a rapid-flow filter. The lump coal was sized to three-fourths by one and one-fourth inches, free of fines, and about eight inches in depth. The overflow is directed onto the filter bed in such a manner that the filter bed is not displaced. When plugged, or upon a routine basis, the filter bed is replaced; the spent bed, composed of coal and solids, is incinerated or landfilled or disposed of by whatever manner is locally in use which does not pollute the atmosphere or surface or underground waters. The potentially most valuable contribution in the work was the finding that conventional sewage sampling does not provide a representative indication of the nature of large solids content. A recommendation for an improved sampling procedure is made. (Woodard-USGS)
W70-09741

AERATED GRIT CHAMBER WITH TANGENTIAL INLET,
Technical Univ. of Prague (Czechoslovakia).
For primary bibliographic entry see Field 05D.
W70-09761

THE PERSISTENCE OF PESTICIDES IN IMPOUNDED WATERS,
Kentucky Water Resources Inst., Lexington.
For primary bibliographic entry see Field 05B.
W70-09768

ENVIRONMENTAL QUALITY AND THE ILLINOIS LAWYER,
John L. DeLaurenti.
Illinois Bar Journal, Vol. 50, p 605-615 (1970). 7 p.

Descriptors: *Illinois, *Environment, *Environmental effects, *Conservation, Resource development, Administrative agencies, Legal aspects, Pollution abatement, Water pollution, Air pollution, Soil contamination, Thermal pollution, Governments, Federal government, State governments, Local governments, Air pollution effects, Regulation, Water pollution effects, Coordination.
Identifiers: *Associations.

The Board of Governors of the Illinois State Bar Association has authorized the creation of an Environmental Control Law Section. A few of the environmental problems recognized by the Section council are: (1) air pollution; (2) water pollution; (3) lethal contamination from pesticides; (4) nuclear radiation; (5) noise; (6) land use; (7) continuing need for historic conservation activities; (8) scrap, junk and solid wates; and (9) population density. A brief discussion of each problem is presented. Most of these problems are under study by various federal agencies, often working without coordination. The lack of agency coordination also exists at the state and local level. The problem of direction and control within Illinois agencies is examined. One of the recent international developments has been the passage of Canadian legislation proscribing the use of the pesticide DDT except in emergency cases. The role of the legal system and lawyers in solving environmental problems will be one of developing a new set of standards which are workable and practical, yet effective. (Powell-Florida)
W70-09784

AGRICULTURAL IRRIGATION AND SALINE QUALITY OF WATER.
For primary bibliographic entry see Field 03B.
W70-09787

OFFSHORE MINERAL RESOURCES: A CHALLENGE AND AN OPPORTUNITY.
For primary bibliographic entry see Field 06E.
W70-09788

ACT NO 769 (DISPOSAL FROM WATERCRAFT OF LITTER AND UNTREATED SEWAGE PROHIBITED).
For primary bibliographic entry see Field 06E.
W70-09790

REPORT TO THE CITY OF FLINT, MICHIGAN ON SANITARY AND STORM SEWER SYSTEMS.
Metcalf and Eddy, Inc., Boston, Mass.

Report to Department of Public Works and Utilities, City of Flint, Michigan, September 12, 1969. 159 p, 11 fig, 12 tab, 11 ref.

Descriptors: *Sanitary engineering, *Sewers, *Sewerage, *Flow separation, *Infiltration, *Drainage systems, *Drainage practices, *Drainage engineering, *Urbanization, *Municipal wastes, *Pollution abatement, *Storm runoff, *Water pollution control, Sewage treatment,

reatment facilities, Flood protection, Flood plan oning, Construction costs, Future planning.
dentifiers: *Combined-sewer separation, *Sanitay sewers, Basement flooding.

he report describes the study procedures and resents the findings, conclusions, and recommenations of an engineering investigation of the dequacy of the sanitary sewer and storm sewer ystems and the waste water disposal facilities of he City of Flint. The sewer systems performed heir present functions satisfactorily; however, ajor problems were: (1) basement flooding, (2) iver pollution, and (3) potential flooding from fuare stormwater discharges from adjoining ownships. In addition to recommendations for ystem improvements and expansion of existing acilities, several far-reaching and unconventional ecommendations were made. One of these is to eparate the downtown combined-sewer system by onstructing a new storm sewer system in this area nd converting the existing combined-sewer to a eparate sanitary sewer. This construction, estiated to cost $2 million, should be effective in educing river pollution and basement flooding om overflows of the present combined-sewer. nother recommendation is to remove all connecons to sanitary sewers from roof drains, foundaon drains, and parking lots. The City should enact egislation to prohibit future connections to the anitary sewer system from foundation drains or ther sources of surface water or groundwater. pecial field investigations of surface and groundater infiltration into existing sewers are also ecommended. A $30,644,000 construction and mprovement program is proposed. The need for ooperation between Flint and Genesee County is tressed, particularly for rainfall and runoff data ollection and flood plain conservation. (Poertner)
W70-09797

HE IMPACT OF THE DEEP TUNNEL PLAN ON THE WATER RESOURCES OF NORTHEAST ILLINOIS.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.

Report to Metropolitan Sanitary District of Greater Chicago, Chicago, Illinois, February 1969. 49 p, 13 fig, 3 ref.

Descriptors: *Tunnels, *Underflow, *Beneficial se, *Underground storage, *Drainage programs, Drainage effects, *Drainage engineering, *Storm unoff, *Surface runoff, *Urbanization, *Water onservation, *Flood control, *Water supply, Water table, *Water resources development, Water pollution control, *Lake Michigan, Sewers, *Resource allocation, *Groundwater echarge, Drainage systems, Navigation, Deep vells, Water allocation.
dentifiers: *Chicago, *Metropolitan Sanitary District of Greater Chicago, *Combined sewer overlows.

The anticipated consequences are described of implementation of the proposed innovative plan for liminating flooding and reducing pollution of waterways from combined sewer overflows in the ervice area of the Metropolitan Sanitary District of Greater Chicago. The plan proposes the conruction of the vertical shafts, and excavation of unnels and storage areas in solid rock deep eneath the ground surface for temporary storage of stormwater runoff which presently floods basenents and streets when sewer capacities are exeeded. Upon cessation of a storm the stored water would be pumped to the ground surface and then to ne of the District's waste water treatment plants or tertiary treatment. The capture of this runoff would make available for beneficial uses an estinated 260 cfs of water. In addition, implementaion of the plan should make possible a 230 cfs eduction in the 945 cfs presently diverted from ake Michigan for maintenance of sanitary condiions in the area's waterways. These savings would ncrease the available water supply by 490 cfs. This s one-half of the forecasted additional water supply that will be required by the year 2000. Other beneficial effects are discussed including: improvements in navigation on the Illinois Waterway, elimination of stream pollution from combined-sewer overflows, and recharge of the area groundwater supply. The basic principles of the plan are discussed, and an evaluation of the plan by the Illinois State Water Survey is included. (Poertner)
W70-09798

POLLUTION AND FLOOD CONTROL, A PROGRAM FOR CHICAGOLAND.
Harza Engineering Co., Chicago, Ill.; and Bauer Engineering, Inc., Chicago, Ill.

Report to Metropolitan Sanitary District of Greater Chicago, Chicago, Illinois, February 1968. 39 p, 7 fig, 2 tab, 5 ref.

Descriptors: *Drainage programs, *Drainage engineering, *Water pollution control, *Flood control, *Tunnels, *Underflow, *Storm runoff, *Surface runoff, *Urbanization, *Lake Michigan, *Drainage systems, *Underground storage, *River regulation, *Sewers, Construction costs, Waste water, Water conveyance, Water quality control, Water pollution treatment, Hydroelectric power.
Identifiers: *Combined sewer overflows, *Chicago, *Metropolitan Sanitary District of Greater Chicago.

A general description is presented of an innovative program for control of water pollution and flooding in the service area of the Metropolitan Sanitary District of Greater Chicago. The report describes the objectives, functions, operation and characteristics of the proposed system, construction time schedules, and estimated construction costs. The plans provide for the construction of vertical shafts to convey overflows, from each of the 400 overflow points of the existing combined sewers, to high velocity conveyance tunnels excavated in rock several hundred feet beneath the ground surface. The overflows would be stored temporarily in a huge reservoir to be excavated in rock 850 feet below Lake Calumet. Upon cessation of overflow and during off-peak hours, the stored water would be pumped to a surface reservoir and then to a treatment plant for treatment prior to discharge to the waterway. The $1,270,000,000 project is proposed to be constructed in 5 construction zones within a 300 square mile area during a 10-year period. The first zone would be completed by early 1973 if construction is begun in early 1970. Hydroelectric power generation is proposed as a part of the system operatin. Cost comparisons with three alternative solutions are given. The engineers estimate that the proposed system can be completed to meet water quality standards of the State of Illinois by the 1977 time limit. (Poertner)
W70-09799

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.
For primary bibliographic entry see Field 05B.
W70-09801

STORM WATER POLLUTION, NEW ORLEANS, LOUISIANA.
New Orleans Sewerage and Water Board, La.
For primary bibliographic entry see Field 05B.
W70-09802

CATAD SYSTEM CONTROLS FOR REGULATION OF COMBINED SEWAGE FLOWS,
For primary bibliographic entry see Field 05D.
W70-09804

FEDERAL PROGRAMS STUDY WASTES FROM RAW AGRICULTURAL PRODUCTS,
Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 05D.
W70-09805

DYNAMIC PROGRAMMING AND ESTUARINE WATER QUALITY CONTROL,
Rice Univ., Houston, Tex. Dept. of Environmental Science and Engineering.
Robert T. Keegan, and J. Venn Leeds, Jr.
Water Resources Bulletin, Vol 6, No 2, p 235-248, March-April 1970. 14 p, 5 fig, 2 tab, 12 ref.

Descriptors: *Dynamic programming, *Optimization, *Estuaries, *Water quality control, *Mathematical models, Constraints, Stochastic processes, Dissolved oxygen.
Identifiers: Algorithm, Langrangian problem, Allocation problems, Galveston Bay System.

An optimization algorithm that allowed one to consider multidimensional water quality models, area growth and various control or decision alternatives for the Galveston Bay System was developed. The problems were formulated as allocation problems and were solved using dynamic programming. The solution to the allocation of resources problem of minimizing (or maximizing) a given scalar valued function of the positive N-vector w subject to constraints upon the use of the resources was obtained by solving the Langrangian problem for a given set of Langrangian multipliers Control or decision variables were included at each activity. The general deterministic water quality problem was formulated to minimize cost of waste treatment and of distribution subject to constraints on quality and to constraints on the maximum amount of waste to be discharged. To illustrate the algorithm the simplest permissible model was used. Stochastic effects and the use of a two-dimensional model were included. Data from the Tracor report on Galveston Bay were selected in order to simulate, to some extent, the water quality of the Houston Ship Channel. The dissolved oxygen deficit resulting from the complete discharge of the wastes was shown . (Kriss-Cornell)
W70-09819

RIGGS V CITY OF SPRINGFIELD (ACTION TO ABATE TEMPORARY NUISANCE NOT BARRED BY STATUTE OF LIMITATIONS).
For primary bibliographic entry see Field 06E.
W70-09825

A DYNAMIC MODEL OF WATER QUALITY MANAGEMENT DECISION-MAKING SYSTEMATIC ANALYSIS OF THE MANAGEMENT EFFECTIVENESS OF THE WATER QUALITY CONTROL BOARD SYSTEM OF CALIFORNIA,
Engineering-Science, Inc., Oakland, Calif. Research and Development Lab.
For primary bibliographic entry see Field 06A.
W70-09908

MARINE WASTE DISPOSAL IN GHANA-WATER QUALITY EVALUATION,
University of Science and Technology, Kumasi (Ghana).
For primary bibliographic entry see Field 05D.
W70-09939

AERATION OF OXYGEN-DEFICIENT IMPOUNDMENT RELEASES,
New Mexico State Univ., Las Cruces.
R. E. Speece.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970, Preprint. 11 p, 8 fig, 5 ref.

Descriptors: *Aeration, *Oxygen demand, *Impoundments, *Dissolved oxygen, Water quality, Hypolimnion, Nitrogen, Bubbles, Injection.
Identifiers: *Water releases, U-tube aeration.

Commercial oxygen is presently competitive with conventional aeration systems in river and impoundment aeration. In addition complete dissolved oxygen saturation can easily be achieved using commercial oxygen whereas conventional aeration becomes increasingly uneconomical above about 40% saturation. In-place hypolimnion

aeration accomplished by injecting small bubbles of commercial oxygen deep in the hypolimnion can provide for complete absorption of the oxygen. Localized mixing for distribution of the dissolved oxygen within the hypolimnion is created by the rising bubbles before they are completely absorbed. Provision to inject into the penstocks of a high dam in combination with inplace hypolimnion aeration can provide a polishing system for positive DO control in the discharge. U-tube aeration with air injection appears to be most advantageous for DO addition where a warm water fishery is involved. It can produce a completely saturated water easily and economically even though it initially contains low DO levels. Intermediate levels of saturation are easily produced by regulating the U-tube depth and rate of air injection. U-tube aeration with air injection does not lend itself to applications where dissolved nitrogen must be below 104%. Aeration of oxygen defficient impoundment releases for improvement of water quality appears to be feasible on a large scale without destratifying the impoundment. Thus the reserve of colder water in the hypolimnion is kept intact for control of downstream temperatures. (Hancuff-Texas)
W70-09944

STEWART V CITY OF SPRINGFIELD (CONSTRUCTIVE CONDEMNATION OF A STREAM BY POLLUTION).
For primary bibliographic entry see Field 06E.
W70-09979

MADDOX V INTERNATIONAL PAPER CO (PAPER MILL'S LIABILITY FOR FISHKILL CAUSED BY WATER POLLUTION).
For primary bibliographic entry see Field 06E.
W70-09980

HAMPTON V NORTH CAROLINA PULP CO (ACTION TO RECOVER FOR FISHKILL CAUSED BY PULP WASTES).
For primary bibliographic entry see Field 06E.
W70-09981

UNITED STATES V FLORIDA POWER AND LIGHT CO (INJUNCTION AGAINST THERMAL POLLUTION).
For primary bibliographic entry see Field 06E.
W70-09982

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME I - INTRODUCTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-193 862, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Report 118, May 1970. 83 p, 16 tab, 29 fig, 7 ref, append. OWRR Project C-1377 (No 1975) (1).

Descriptors: *Simulation analysis, *Optimization, *Computer programs, *Planning, *Management, Systems analysis, Reservoirs, Water resources, Texas.
Identifiers: Transfer links.

The research project developed applied new and existing techniques to the planning of complex water and related land resource systems of the Trans-Texas Division of the Texas Water Plan, a system of major proportions that involved many reservoirs, canals, and pumping facilities spanning the state of Texas. The planning problem posed was how best to develop such a system, given the necessity to meet the predetermined demand schedule over the 50-year planning horizon. Such questions as: when should elements of the system be constructed and available for service; how large should they be; how much water should be imported; and others were posed. To provide the planner with some objective and reliable means for answering such questions and for investigating systematically the alternatives presented, the systems approach technique used utilized four specialized computer programs: Stage Development, Simulation Program I, Simulation Program II and the Allocation Program. The screening procedure which used these four programs was divided into four distinct phrases: Element Sizing and Reservoir Operating Rules, Initial Screening using the Stage Development Program, Secondary Screening to refine the schedule and improve element sizes, and Final Screening using the Allocation Program where actual inputs and demands over the planning horizon were used and constraints imposed. The significant conclusion given was that the approach, developed and tested, for the screening of alternative water resource development plans, was efficient and feasible. (See also W70-09512 thru W70-09519) (Kriss-Cornell)
W70-09511

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-A - SIM-I - PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 086, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol II-A - SIM-I Program Description, August 1969. 143 p, 13 fig, 12 tab, 4 append. OWRR Project C-1377 (No 1975) (2).

Descriptors: *Simulation analysis, *Computer programs, *Reservoirs, *Conduits, *Optimization, Design data, Management, Texas, Water storage, Water transfer.
Identifiers: Stage-development program.

A full description of SIM-I; the annual stage-development and seasonal operation of the predefined multi-basin water resource storage and transfer scheme of the Texas Water Plan, was given. The program computed seasonal spills and deficiencies, storage levels, river flows, and pump-canal transfer rates, and then computed costs for pump power, imported water, and staged construction of storage and transfer facilities. System geometry, cost data, and hydrologic data were input parameters. SIM-I was an efficient method for evaluating the operational feasibility and costs of alternative system configurations and constraints for the generalized multi-basin system of reservoirs and conduits. The program was designed to operate as a stand-alone analysis tool or to operate as a subprogram in the stage-development program. Simulation of the system operation was described by a series of steady state solutions, one for each time step, that satisfy continuity for all storage elements. Data requirements, program capabilities, and program descriptors were given for the system. (See also W70-09511) (Kriss-Cornell)
W70-09512

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-B - SIM-II PROGRAM DESCRIPTION.
Texas Water Development Board, Austin, Texas.

Available from NTIS as PB-194 087, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol II-B - SIM-II Program Description, Aug 1969. 120 p, 5 fig, 14 tab. OWRR Project C-1377 (No 1975) (3).

Descriptors: *Simulation analysis, *Optimization, *Computer programs, *Cost, *Time, Water transfer, Management, Texas.
Identifiers: Nodes, Links.

SIM-II was a computerized procedure designed to simulate and optimize certain behavioral characteristics and aspects of the large scale surface water distribution system of the Texas Water Plan. The computer program simulated the storage response of the system while at the same time minimized the total cost of material transfer within the complicated network. A solution was produced for each finite time interval with analysis moving forward in a step-wise fashion. SIM-II was more flexible and realistic than SIM-I but with higher cost of operation. It used less computer time than the Allocation Program but solutions were only a series of suboptimal time step solutions, not solutions over an entire time span. Six solution steps were followed and two primary analytical tasks were performed: simulation of storage levels and determination of intersystem transfers to meet storage levels at minimum cost. SIM-II could simulate and optimize a network with up to 30 nodes and 45 links. Mathematical descriptors, data requirements, program capabilities and program descriptions were given. (See also W70-09511) (Kriss-Cornell)
W70-09513

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-C - ALLOCATION PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 088, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol II-C - Allocation Program Description, Aug 1960. 168 p, 12 tab, 9 fig. OWRR Project C-1377 (No 1975) (4).

Descriptors: *Optimization, *Computer programs, *Reservoirs, *Canals, *Networks, Flow, Cost, Time management, Texas.
Identifiers: *Allocation program, Out of kilter algorithm.

An Allocation Program was used to find the minimum cost way of transferring water through a network of reservoirs and canals, the sizes of reservoirs and canals, and reservoir operating rules for use in Simulation programs. The problem was structured as a network flow problem and then solved by the 'Out of Kilter Algorithm'. The results included, for the time period simulated, all canal and river flows, reservoir storage levels, import quantities, and power needs. The marginal costs of the canal and reservoir sizes were also determined. A trial and error process sized the facilities and was used to check the timing of their construction. A complete description of the program was given. (See also W70-09511) (Kriss-Cornell)
W70-09514

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-D - STAGE DEVELOPMENT PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 089, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol II-D - Stage Development Program Description, Aug 1969. 89 p, 9 fig, 10 tab. OWRR Project C-1377 (No 1975) (5).

Descriptors: *Optimization, *Simulation analysis, *Project planning, *Time, *Cost, Variability, Reservoirs, Canals, Management, Texas.
Identifiers: *Stage development.

The Stage Development PROGRAM, AS PART OF THE OVERALL Texas Water Plan, was used to estimate the sequence of project construction over a 50 year planning horizon in order to produce the least costly system of reservoirs and canals, and satisfy the demand for water. The planning horizon was divided into 3 periods consistent with the political and physical constraints. Three different calculations involved: (1) net hydrologic balance giving storage needs as a function of time; (2) random sampling of possible construction start times of system elements with the costs of each element estimated using simulation; and (3) a deterministic sequential search using simulation to improve a given set of possible start times. The entire simulation was thought of a s a system response function: th independent variables of the function were reservoir and canal construction times and the dependent variables were the present value of construction and operation costs of the water resource project and cumulated project shortages over the planning horizon. Simulation and Allocation programs were used. (See also W70-09511) (Kriss-Cornell)
W70-09515

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME III - DATA MANAGEMENT.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 090, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol III - Data Management, Aug 1969. 229 p, 10 fig. OWRR Project C-1377 (No 1975) (6).

Descriptors: *Data processing, *Simulation analysis, *Optimization, *Computer programs, Data storage and retrieval.

Data management activities for the Texas Water Plan were developed to assist in data preparation for the system's simulation study. It provided the user with a problem-oriented and easily used set of computer programs for supplying most of the information required by the simulation and optimization programs. Four computer programs resulted: Curfit-I, Tapewrite II, Update I, and Portgen I. They functioned in a way designed to insure the proper generation of a single comprehensive tape file capable of supplying input to the simulation and optimization programs. The programs consisted of computer coded instructions that read data cards containing information prepared by the user on problem-oriented input data forms. The programs were used separately but could function as an integrated set of programs. All four programs were described in detail and mathematical descriptions were used. (See also W70-09511) (Kriss-Cornell)
W70-09516

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME IV - USERS MANUAL.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 091, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol IV - Users Manual, Aug 1969. 195 p, 16 fig. OWRR Project C-1377 (No 1975) (7).

Descriptors: *Computer programs, *Simulation analysis, *Optimization, *Data collection.

The Users Manual provided a reference document that describes how to use the following computer programs: Curfit I, Tapewrite II, Update I, Portgen I, SIM-I, SIM-II, Allocation Program and Stage Development Programs. The descriptions for each of the programs included: (1) statements of purpose; (2) explanation of capabilities, limitations, and assumptions; (3) presentation of problem-oriented input forms; (4) descriptions of the data required on the input forms; (5) discussion of the card sequencing requirements; (6) presentation of examples of printer output generated by each of the programs; and (7) a description of the contents of the common input tape file used with the SIM-I, SIM-II, Allocation and Stage Development Programs. The descriptions reflected the capability of the programs which were debugged and tested on the UNIVAC 1108 using a single comprehensive example problem. (See also W70-09511) (Kriss-Cornell)
W70-09517

A COMPLETION REPORT ON SYSTEM SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME-V - STOCHASTIC DEMAND PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.

Available from NTIS as PB-194 092, $3.00 in paper copy, $0.65 in microfiche. Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol V - Stochastic Demand Prog Descrip, Aug 1969. 48 p, 3 fig, append. OWRR Project C-1377 (No 1975) (8).

Descriptors: *Stochastic processes, *Computer programs, *Irrigation design, Agriculture, Demand, Synthetic hydrology, Runoff, Texas, Management, Simulation, Optimization.

The construction of a stochastic technique for the generation of areawide demands was investigated and recommendations for implementation of a resultant computerized procedure were presented. The study, by Dr. G. K. Young of Water Resources Engineering, Inc. represented a first attempt to develop a procedure to generate stochastic agricultural demands for irrigational water on a unit acre basis for prespecified cropping patterns, soil conditions, irrigation efficiencies and effective rainfall assumptions. The soil moisture accounting technique used by the Texas Water Development Board served as a comprehensive source of information concerning irrigation computations and predictions. It was concluded that a specially tailored version of the technique be employed, in conjunction with stochastic hydrology and an artificial data generator to calculate synthetic demands. An additional conclusion was that runoff data should be incorporated into the stochastic generating process. Stochastic hydrology and irrigation prediction techniques were synthesized by a two-step procedure to calculate synthetic demands. The stochastic procedures were developed in conjunction with the simulation and optimization programs but no attempt was made to insure their direct compatability with each other. (See also W70-09511) (Kriss-Cornell)
W70-09518

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME VI - RESEARCH ACCOMPLISHMENT AND COST SUMMARY.
Texas Water Development Board, Austin.

Completion Report of the Texas Water Development Board and Water Resources Eng, Inc, Vol VI - Research Accomp and Cost Summary, Aug 1969. 11 p, 1 fig, 8 ref, 1 append. OWRR Project C-1377 (No 1975) (9).

Descriptors: *Computer programs, *Costs, *Research, Water Resources planning, Texas, Water management (Applied), Scheduling.

A computer-oriented planning system for use in the planning of large, multi-basin systems of reservoirs and connecting river reaches and pump-canals of the proposed Texas Water System was summarized. Nine interrelated computer programs and the approach for using these programs were developed. They were of five types: Data Management Programs, Simulation Programs, Stage Development Programs, Allocation Programs, and Stochastic Demand Programs. The purpose of all five types and their corresponding subdivisions were reviewed. A detailed project schedule was given where the first significant step was taken in June of 1967. 'Conceptual approaches' to the solution of the water development problems in Texas were submitted by seven firms. A 'Consulting Panel' was formed by the Board that defined the framework of the needed research and provided guidance to the research staff. A Systems Engineering Group was created to provide for developing an 'in-house' capability of using results of the first year's research and to conduct future studies and complete the computer-oriented planning system by 1972. The specifications of the research project proposed for the fiscal year 1970 were given along with the estimated expenditures, a list of research education and publication benefits, and the research staff. (See also W70-09511) (Kriss-Cornell)
W70-09519

FINAL PROGRESS REPORT DELAWARE ESTUARY AND BAY WATER QUALITY SAMPLING AND MATHEMATICAL MODELING PROJECT.
Delaware River Basin Commission, Trenton, N.J.

Available from NTIS as PB-193 799, $3.00 in paper copy, $0.65 in microfiche. Delaware River Basin Commission, May 1970. 105 p, 10 tab, 27 fig, 10 ref. FWQA Project 16090 DCL...5/10.

Descriptors: *Mathematical models, *Dissolved oxygen, *Biochemical Oxygen Demand, *Pollution abatement, *Water quality, Water pollution, Oxygen sag, Organic wastes, Waste water treatment.
Identifiers: *Parameters of biochemical oxygen demand, Carbonaceous biochemical oxygen demand, Nitrogenous oxygen demand.

This is a report on a demonstration grant from the Federal Water Pollution Control Administration. The principal contents are comparisons of water quality parameters for the Delaware Estuary with those previously estimated for years ending 1963. Data on water quality were also obtained for a number of major pollution sources. Comparisons show that previous mathematical models for the Delaware Estuary can still be used to verify dissolved oxygen levels. Current levels of dissolved oxygen fail to meet the standards established by the Commission. It is stated that in the future, regulation of carbonaceous raw waste of industry and municipalities will be sufficient to meet these standards, but no basis for this prediction is outlined in the report. This report provides background for further analysis of economically feasible alternatives programs on the Delaware River. (Whipple-Rutgers)
W70-09526

MATHEMATICAL MODELLING OF WATER QUALITY CHANGES IN A RIVER BASIN,
Hydraulic Research Inst., Brno (Czechoslovakia).
For primary bibliographic entry see Field 05G.
W70-09593

THE MATHEMATICAL MODELING OF A STRATIFIED ESTUARY,
Imperial Chemical Industries Ltd., Billingham (England). Heavy Organic Chemical Div.
For primary bibliographic entry see Field 02L.
W70-09607

OPTIMAL RESOURCE USE OVER TIME WITH AN APPLICATION TO GROUNDWATER,
California Univ., Davis.
For primary bibliographic entry see Field 02F.
W70-09649

OPTIMAL TAXING FOR THE ABATEMENT OF WATER POLLUTION,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 05G.
W70-09652

A NOTE ON THE RELATION BETWEEN BINARY AND MULTIPE CHOICE PROBABILITIES,
Presidency College, Calcutta (India); and London School of Economics and Political Science (England).
S. K. Chakrabarti.
Econometrica, Vol 37, No 4, p 726-727, Oxtober 1969. 2 ref.

Descriptors: *Probability, Mathematical studies.
Identifiers: *Binary choice, Ranking.

At the end of his classic paper, 'Threshold in Choice and the Theory of Demand.' Nicholas Georgescu-Roegen raised a significant problem. Namely, 'What axioms are logically necessary and experimentally justified, to relate the multiple choice probability to that of the binary choice.' In this note a simple ranking postulate is proposed as a possible answer to this situation. This article may prove of interest to the researcher in the water area concerned with mathematical models making use of the theory of probability in the context of threshold variables. (Loeb-Rutgers)
W70-09660

STOCHASTIC STABILITY OF SHORT-RUN MARKET EQUILIBRIUM: COMMENT,
Rutgers - The State Univ., New Brunswick, N.J. Bureau of Conservation.
E. Roy Weintraub.
Quarterly Journal of Economics, Vol LXXXIV, No 1, p 161-167, February 1970.

Descriptors: *Stability, *Equilibrium, Prices, Supply, Risks.
Identifiers: *Stochastic stability, *Market equilibrium, *Shocks, Discrete time model, Linear stochastic model, Walrasian stability, Marshallian stability, Random shocks, Dynamic analysis.

Comments are made on a recent article by Stephen J Turnovsky in which random disturbances were introduced into a cobweb model and which showed that stochastic parameters were crucial for the analysis of stochastic stability. This note shows that the techniques of stochastic stability analysis used by Turnovsky in the case of discrete time systems can be carried over to continuous time to generalize the usual Marshallian and Walrasian stability conditions. A second purpose of this note is to present briefly some salient features of stochastic stability theory. This may prove helpful in analyzing equilibrium and stability in the water resources area where the problem is analyzed via a cobweb model or via simple multiplicative and additive continuous time stochastic systems that reflect risk or uncertainty in the water demand and supply functions. (Loeb-Rutgers)
W70-09661

EXTERNALITIES AND OUTPUT TAXES,
Washington Univ., Seattle.
Lowell R. Basset, and Thomas E. Borcherding.
The Southern Economic Journal, Vol 36, No 4, p 462-464, April 1970. 1 fig, 5 ref.

Descriptors: *Taxes, Supply.
Identifiers: *Externalities, *Output, Inferior input, Short-run, Long-run, Output tax.

It is demonstrated that under widely used assumptions a tax on output will always cause a long-run reduction in the amount of the externality supplied by the industry whether the input producing the externality is inferior or normal to the firm. Further, the authors extend the analysis of an output tax to a general model, namely an n-input, competitive-market model with imperfectly elastic factor supply functions facing the taxed industry. In this case comparative statics results are not necessarily determinate; however, this ambiguity does not arise because of the presence of an inferior factor but because of the general problem of complementarity. This analysis may prove applicable to the water area when analyzing the effect on the externalities created by a water related industry when a tax is imposed upon the output of that industry. (Loeb-Rutgers)
W70-09666

FIRST ORDER CERTAINTY EQUIVALENCE,
California Univ., Berkeley.
E. Malinvaud.
Econometrica, Vol 37, No 4, p 706-718, October 1969. 7 ref.

Descriptors: *Risks, Probability, Value, Decision making.
Identifiers: *Certainty equivalence, Decision, Quadratic payoff, Dynamic problem, Instruments, Payoff function, Strategy.

The classical certainty equivalence theorem states that the optimal decision in a risky situation is the same as in some associated riskless situation. It holds true under rather specific conditions; quadratic payoff, and linear relations between instruments and results. When these conditions are not met but the various functions involved are differentiable, an approximate property can still be stated. The property is proved and discussed for the following well known dynamic problem: when information accumulates over time how should one choose the sequence of values to be given to some instruments. This paper may prove helpful to the theoretical problems in decision making in the water area. (Loeb-Rutgers)
W70-09667

RIVER FLOW FORECASTING THROUGH CONCEPTUAL MODELS: PART 2 - THE BROSNA CATCHMENT AT FERBANE,
Institute of Hydrology, Wallingford (England).
P. E. O'Connell, J. E. Nash, and J. P. Farrell.
Journal of Hydrology, Vol 10, No 4, p 317-329, June 1970. 13 p, 5 fig, 1 tab, 4 ref.

Descriptors: *Mathematical models, *Rainfall-runoff relationships, Computer programs, Rational formula, Simulation analysis, Model studies, Hydrographs, Hydrograph analysis, Precipitation (Atmospheric), Runoff forecasting, Routing, Hydrologic budget, Water balance, Parametric hydrology.
Identifiers: Brosna watershed (Ireland), Ferbane (Ireland).

An attempt to model the runoff process on the Brosna catchment is described. The Brosna catchment covers some 458 square miles in the center of Ireland and drains into the Shannon. The catchment is very flat except where some glacial deposits provide some relief. Two lakes cover 10 square miles at the upper end of the catchment. The underlying carboniferous limestone is covered by boulder clay which supports grazing land and some peat bogs with a little woodland. There is no noticeable evidence of substantial groundwater movement across the topographical boundary. The model accounts for 80-85% of the initial variance. Interdependence among the parameters must be avoided if the optimum values of the parameters are to be well defined. Much better results could be achieved by further elaboration of the model. (Knapp-USGS)
W70-09698

DEVELOPING A HYDRO-QUALITY SIMULATION MODEL,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-09740

DYNAMIC PROGRAMMING AND ESTUARINE WATER QUALITY CONTROL,
Rice Univ., Houston, Tex. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 05G.
W70-09819

MATHEMATICAL MODELS IN SOIL PRODUCTIVITY STUDIES, EXEMPLIFIED BY THE RESPONSE TO NITROGEN,
Institute for Land and Water Management Research, Wageningen (Netherlands).
For primary bibliographic entry see Field 02G.
W70-09820

ON LINEAR PROGRAMMING IN A MARKOV DECISION PROBLEM,
Yale Univ., New Haven, Conn.
Eric V. Denardo.
Management Science, Theory, Vol 16, No 5, Jan 1970, p 281-288, 8 p, 20 ref. NSF Grant GK-13757.

Descriptors: *Markov processes, *Linear programming, *Optimization, Decision making, Planning, Analytical techniques.
Identifiers: Iteration algorithm, Choice.

Numerous water resources models incorporate Markow processes. An undiscounted Markov decision model with an infinite planning horizon was described. The model was analyzed by application of a linear program first proposed by Manne for a special case of the model. A brief description and comparison of a single-chain policy iteration routine with a complex multichain policy iteration algorithm which computed an optimal policy was given. It was shown that Manne's single-chain linear program found the ergodic chain that optimized the gain rate over all chains, regardless of chain structure. This solves optimization problems in which the decision-maker has his choice of policy and of starting state. It was then shown how to embed the single-chain program in a decision procedure that finds a gain maximizing policy efficiently in all cases, simple or complex. A Markov renewal programming model was introduced with finite states or regeneration points. A program to generalize Manne's program to the Markov renewal model was used as the primary tool in a procedure described for computing a gain optimal policy. A second program was considered which was analogous to linear programming for discounted Markov decision problems. (Kriss-Cornell)
W70-09821

A FRACTILE APPROACH TO LINEAR PROGRAMMING UNDER RISK,
Iowa State Univ., Ames. Dept. of Economics.
J. K. Sengupta, and J. H. Portillo-Campbell.
Management Science, Theory, Vol 16, No 5, Jan 1970, p 298-308. 11 p, 7 tab, 15 ref. NSF Project GS-1810/420-21-17.

Descriptors: *Linear programming, *Risles, Theoretical analysis, Stochastic processes, Optimization, Variability, Probability, Profit.
Identifiers: Computational analysis, Empirical analysis, Fractile criterion.

The implications of a fractile approach to linear programming under risk through maximizing a given fractile of the distribution of profits under linear programming restrictions were examined both theoretically, computationally and empirically. In recent years the water resources linear programming models have increasingly incorporated concepts of risk and uncertainty through the various approaches of probabilistic programming; e.g., chance-constrained programming stochastic programming etc. An investigation of the implications of some of the simple methods of risk programming using three optimization criteria, e.g., expected value, the fractile and the portfolio criterion was given. In the expected value criterion

he expected profit level was maximized, whereas he portfolio criterion minimized (i.e. variability) of total profit subject to some minimum expected profit. The fractile criterion sought to maximize the alpha-fractile of the cumulative probability distribution of profits with the value of alpha preassigned by the decision maker. Advantages of the fractile criterion applied to linearprogramming problems under risk were illustrated and the approach was discussed under the assumption that he profit function was normally distributed. (Kriss-Cornell)
W70-09822

EXPERIMENTAL DESIGNS FOR COMPUTER SIMULATION EXPERIMENTS,
Princeton Univ., N. J.; and Duke Univ., Durham, N. C.
. S. Hunter, and T. H. Naylor.
Management Science: Theory, Vol 16, No 7, March 1970, p 422-434. 13 p, 1 fig, 2 tab, 31 ref. NSF Grant GS-1926.

Descriptors: *Simulation analysis, *Computer program, *Mathematical models, Design, Optimization, Analytical techniques.
Identifiers: Practical problems.

Within the context of two simulation experiments with an inventory model, the paper discussed factorial, franctional factorial, rotatable, and response surface designs. Careful attention to experimental design questions prior to conducting a simulation experiment was given. Experimental designs were available for: (1) investigating the relationship of the response to the factors in order to determine the underlying mechanisms governing the process under study and (2) finding the combination of factor levels at which the response variable is optimized. These designs were not only economical but provided a structure for the investigator's learning process. A full description of a simulation model was given and the following four activities were described: formulation of a computer program, validation, experimental design, and analysis of simulated data. An example model was used and two different types of simulation experiments were described - an explanatory model and an optimization model. A number of practical problems which arise in designing simulation experiments were described as the problem of sample size, the multiple response problem, the problem of nonlinearity, the problem of convergence, and the problem of constrained optimization has application to water resources simulation modeling. (Kriss-Cornell)
W70-09823

EFFECT OF THREE VOTING RULES ON RESOURCE ALLOCATION DECISIONS,
Pittsburgh Univ., Pa. Graduate School Business.
Jacob G. Birnberg, Louis R. Pondy, and C. Lee Davis.
Management Science: Application, Vol 16, No 6, Feb 1970, p B356-372. 17 p, 8 tab, 25 ref.

Descriptors: Resource allocation, Decision making, Budgeting, Capital, Laboratory tests, Model studies, Variability.
Identifiers: Voting rules.

The effect of the voting rule adopted by a capital budgeting committee on the allocation of resources among divisions was examined. The results of a laboratory experiment indicated that different voting rules have different characteristics measured in terms of the size of the total budget allocation made and the interdivision variability. In addition, an attempt was made to ascertain the techniques used by the groups to reach a decision. Four possible models were developed: the random choice model, the long run cooperative model, the short run competitive model, and the gaming model. None of the four models offered provided an adequate explanation of the observed behavior. However, a mixed model consisting of two of the approaches did provide a reasonable explanation for the observed behavior. (Kriss-Cornell)
W70-09824

A SIMULATION MODEL OF CAPITAL BUDGETING UNDER UNCERTAINTY,
Texas Univ., Austin.
Rodolfo Salazar, and Subrata K. Sen.
Management Science: Application, Vol 15, No 4. Dec 1968, p B161-B179. 19 p, 7 fig, 5 tab, 24 ref.

Descriptors: *Simulation analysis, Capital costs, *Budgeting, Investment, *Stochastic processes, *Linear programming, *Risks, Mathematical models, Management, Constraints.
Identifiers: Weingartner's Basic Horizon model.

A simulation model of capital budgeting under uncertainty is described. It analyzed the effects of two types of uncertainty which influence the cash flows of the potential investment projects. Techniques of simulation and stochastic linear programming (using Weingartner's Basic Horizon model of capital budgeting) were employed to compute the expected return (with an associated measure of the risk involved) of different portfolios of projects. The manager could then select the portfolio which was closest to his personal risk-return preference. The model provided a practical guide to management in the entire process of project search, portfolio generation, and portfolio evaluation which characterizes the capital budgeting decision. Several formal mathematical programming techniques recently proposed for handling uncertainty were mentioned: Stochastic linear programming, linear programming under uncertainty and chance-constrained programming. The approach taken in this paper utilized concepts of decision trees simulation, and stochastic linear programming. Has numerous applications to water resources capital budgeting problems. (Kriss-Cornell)
W70-09826

AN APPROACH TO LINEAR PROGRAMMING WITH 0-1 VARIABLES,
Keio Univ., Tokyo (Japan).
Shiyuo Senju, and Yoshiaki Toyoda.
Management Science: Application, Vol 15, No 4, Dec 1968, p B196-B207. 12 p, 7 fig, 6 tab, 2 ref, 1 append.

Descriptors: *Linear programming, *Variability, *Decision making, *Optimization, Mathematical models, Profit.
Identifiers: Integer programming.

Not infrequently water resource planning alternatives are presented as fixed; i.e., a project is to be built to its specified capacity or not at all. The article presented a simple approach to obtaining approximate solutions to decision making problems in which one seeks to choose the optimal package from a large number of indivisible independent proposals. The fundamental concept was to make some ordinal scales among proposals. Steps of calculation were illustrated by examples of choosing the optimal mix of orders, one of which involved 60 candidate proposals with 30 restricting conditions. The problem was formulated in mathematical terms and was a special case of the interger programming problem often called the 'Knapsack Problem'. A simple numerical example was used to illustrate the problem of choosing the optimal package of orders so as to maximize the total profit, with an order either fully accepted or not accepted with no in-between condition. A two-dimensional vector notation expressed the relations between proposed orders and limiting conditions. Improvements of the procedure and some generalizations were made. An example with four restricting conditions and a large scale example were also given. The advantages of the method were presented in the conclusion. (Kriss-Cornell)
W70-09827

MARKOV CHAINS AND EMBEDDED MARKOV CHAINS IN GEOLOGY,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
William C. Krumbein, and Michael F. Dacey.
Report available from NTIS as AD-704 748, $3.00 in paper copy, $0.65 in microfiche. Northwestern University, Department of Geological Sciences Technical Report No 12, April 1970. 18 p, 42 ref. ONR Contract No NR 389-150 and 389-153.

Descriptors: *Hydrologic data, *Data processing, *Statistical methods, *Markov processes, Stochastic processes, Statistics, Mathematical studies, Simulation analysis, Synthetic hydrology, Geology, Hydrology, Data collections, Bibliographies, Reviews, Stratigraphy, Sedimentation.
Identifiers: Geological data.

Geological data are structured as first-order, discrete-state discrete-time Markov chains in two main ways. In one, observations are spaced equally in time or space to yield transition probability matrices with nonzero elements in the main diagonal; in the other, only state transitions are recorded, to yield matrices with diagonal elements exactly equal to zero. The mathematical differences in these two approaches are reviewed here, using stratigraphic data as an example. Simulations from chains with diagonal elements greater than zero always yield geometric distributions of lithologic unit thickness, and their use is recommended only if the input data have the same distribution. For thickness distributions lognormally or otherwise distributed, the embedded chain is preferable. The mathematical portions of this paper are well known, but are not readily available in publications normally used by geologists. One purpose of this paper is to provide an explicit treatment of the mathematical foundations on which applications of Markov processes in geology depend. (Knapp-USGS)
W70-09848

MARKOV CHAIN MODELS OF TURBULENT DIFFUSION,
Cambridge Univ. (England). Cavendish Lab.
For primary bibliographic entry see Field 02E.
W70-09860

A DYNAMIC MODEL OF WATER QUALITY MANAGEMENT DECISION-MAKING SYSTEMATIC ANALYSIS OF THE MANAGEMENT EFFECTIVENESS OF THE WATER QUALITY CONTROL BOARD SYSTEM OF CALIFORNIA,
Engineering-Science, Inc., Oakland, Calif. Research and Development Lab.
Richard M. Males, William E. Gates, and Junius F. Walker.
Available from NTIS as PB-194 335, $3.00 in paper copy, $0.65 in microfiche. Engineering-Science, Research and Development, Final Report, May 1970. 44 p, 11 fig. OWRR Project C-1496 (no. 1989).

Descriptors: *Decision-making, *Behavior, *California, *Administrative decision, *Water quality control, *Simulation analysis, *Systems analysis, *Social change.
Identifiers: *Enviromental system dynamics, *Dynamics of social systems, *Industrial dynamics, *Behavioral science.

Techniques of behavioral science and systems analysis were utilized to analyze the internal decision-making structures of the Regional Water Quality Control Board of California. The Board was treated as a three-component entity which responds dynamically to information inputs from pressure groups. The decision-making process was taken as consisting of functional areas: (1) generation of pollution; (2) perceived level of actual pollution; (3) desired level of water quality; (4) desired rate of adjustment between existing and desired quality; (5) negotiation of response between interest groups. Based on the above framework, a computer simulation model of the decision-making process was developed. Data for the model were obtained from partially structured interviews and from case studies. The model is capable of characterizing behavior of the decision-making process as a function of a number of physical and behavioral

parameters. Informal, rather than formal objectives govern the operation of the Board. The regional board system of California is effective insofar as it can achieve cooperation on the part of those dischargers holding strong vested interests in the area. Long delays between problem identification and resolution are inherent in the system.
W70-09908

ENVIRONMENTAL SIMULATION AS A TOOL IN A MARINE WASTE DISPOSAL STUDY OF JAMICA BAY,
Rand Corp.
For primary bibliographic entry see Field 05D.
W70-09937

6B. Evaluation Process

LAKE MICHIGAN BASIN STUDY: MICHIGAN SECTION.
League of Women Voters of Michigan, Detroit.

Available from the League of Women Voters of Michigan, 4612 Woodward Ave, Room 317, Detroit, Michigan, 48201. Price-30 cents. League of Women Voters of Michigan, Detroit, Michigan, January 1968. 36 p, 1 dwg, 17 ref, (Mimeographed).

Descriptors: *Lake Michigan, *Michigan, *Administrative agencies, *Hydrology, *Geology, *Water resources development, *Water supply, *Pollution abatement, *Flood control, *RIrrigation, *Navigation, *Watershed Protect. and Flood Prev. Act, *Recreation, *Fish, *Wildlife.
Identifiers: *Western Michigan Lake Shoreline, *Upper Peninsula-Eastern Area, *Lower Peninsula-Northwestern Area, Act 253.

The Michigan section of the Lake Michigan is described in terms of physical characteristics and water-related activities. Geological and hydrological conditions are reviewed including information regarding lake current, lake levels, water quality, tributary streams in Michigan and aquatic life. In 1960 there were more than 2.5 million people in this section of Lake Michigan. The economy of the basin is considered in three areas: Western Michigan Lake Shoreline, Upper Peninsula-Eastern Area, and Lower Peninsula-Northwestern Area. Agriculture, and to a lessening degree logging, have dominated the basin as a whole; the use of Lake Michigan water for irrigation has been of little significance. Water supply for approximately 650,000 comes from Lake Michigan. Principal sources of water supply are listed as are state and federal agencies with responsibilities in this connection; it is concluded that groundwater is being depleted faster than it is being replenished. A variety of pollution sources and efforts at abatement are reviewed. Included is discussion of sanitary disposal systems, industrial waste, large and small craft, and appropriations. Magnitude of flooding and projects and agencies dealing with it are listed; the same is done for irrigation. Power generation using hydroelectric coal-fired, and eventually nuclear steam generation systems is discussed with reference to its effect on water. Commercial navigation has been and will continue to be of great significance to the area; discussion of eight harbors is given. Watershed projects stemming from Act 253 and PL 566 are indicated. Finally listed are facilities and available resources for boating, camping, fishing and hunting. (Preckwinkle-Chicago)
W70-09622

LAKE MICHIGAN BASIN STUDY-ILLINOIS SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter League Group.

League of Women Voters, Chicago, 1968. 31 p. (Mimeographed)

Descriptors: *Lake Michigan, *Illinois, *Water resources development, *Water utilization, *Pollution abatement, *Administration, *Geology, *Flood control, *Recreation, *Navigation, *Irrigation, *Watershed management, Electric power.
Identifiers: *Chicago, Geography, Illinois Sanitary Water Board, Chicago Water Board, Metropolitan Sanitary District, Northeastern Illinois Planning Commission, North Shore Sanitary District, Lake diversion.

The Illinois section of the Lake Michigan basin is described with summaries of geological and geographical characteristics of the area. Efforts at pollution abatement, flood control, irrigation and water use in power generation and recreation are discussed, and finally outline of administrative organization, navigation, watershed management, and international and interstate commissions is made. The Chicago area's effect is emphasized because of its great population concentration and the problems which arise with regard to water supply, transportation, and waste disposal. Limitations on lake diversion serve as an example here. Indicated as especially important are the Sanitary Water Board, the Chicago Water Board and the Metropolitan Sanitary District along with an advisory agency, the Northeastern Illinois Planning Commission. A study of water supply needs published by this latter agency is reviewed with projections for each of the six counties included. Pollution abatement efforts directed toward the North Shore Sanitary District and industrial polluters are discussed as are the efforts of a number of federal and interstate agencies and state agencies. The magnitude of the flooding problem is discussed with reference especially to sewer overflow. With regard to recreation, federal agencies' responsibilities are summarized. Because of the numerous local, regional, and state agencies concerned with water resources development, an effort is also made to summarize their responsibilities. Navigation is reviewed in terms of facilities and pollution problems. Watershed management problems are indicated and practices and programs to deal with them mentioned. Finally described are five commissions dealing with interstate and international concerns. Preckwinkle-Chicago
W70-09623

LAKE MICHIGAN BASIN STUDY: WISCONSIN SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.

League of Women Voters, Wisconsin, 1968. 10 p, 11 ref. (Mimeographed).

Descriptors: *Lake Michigan, Wisconsin, Geology, Population, Water resources development, Legislation, Water supply Pollution abatement, Flood control, Electric power, Irrigation, Navigation, Watershed management, Industrial wastes, Sewage treatment, Pulp wastes, Fishing, Wildlife.
Identifiers: *Northeastern Wisconsin, Southeastern Wisconsin, Milwaukee, Green Bay.

The Wisconsin section of the Lake Michigan basin is described with brief summaries of physical characteristics, population characteristics, economic characteristics and water related activities and characteristics. Included are descriptions of water supply, pollution abatement, flood control, power generation, irrigation, navigation, watershed management, recreation, fish and wildlife. Because of regional differences the northeastern and southeastern sections of Wisconsin are considered separately. The northeastern section centers around Green Bay. Population in this section is expected by 2020 to nearly double the 1960 level of 778,000. Principal occupations are listed and because of the importance of lumber the waste load from pulp and paper is an important contribution to pollution. The southeastern section has a population of 1,674,000 and with a 59.9 increase expected between 1963 and 1990 it is one of the nation's fastest growing large metropolitan regions. Six major and five minor watersheds are listed with groundwater as contributing to the water supply. In much of the region, flooding is a recurring problem and with continued urbanization this is expected to increase. Approximately 59 of urban developed area is served by facilities from Lake Michigan. Commercial shipping, confined to the Milwaukee Harbor area, is described as are recreational areas. State control of water resources brought about by 1966 legislation is discussed. Finally, the work of Southeastern Regional Planning is reviewed. Included is a statement from the agency pinpointing municipal sewage plants as the most important sources of pollution in the region. (Preckwinkle-Chicago)
W70-09624

LAKE MICHIGAN BASIN STUDY: INDIANA SECTION-1.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.

League of Women Voters, Indiana, 1968. 9 p, 1 map, 5 ref. (Mimeographed).

Descriptors: *Lake Michigan, *Indiana, *Geology, *Population, *Water resources development, *Water supply, *Pollution abatement, *Electric power, Navigation, Administration, Watershed management, Recreation, Flood control, Irrigation, Industrial wastes, Sewage treatment.
Identifiers: *Lake Michigan basin, *St. Joseph river basin, Burns Ditch, Indiana Dunes.

The Indiana section of the Lake Michigan basin is described with summaries of physical characteristics, population, and economy. Groups active in water resources development are listed and discussion given to water supply, pollution problems, flooding, irrigation, power generation, navigation, watershed management, and recreation. In addition to the Lake Michigan basin, the St. Joseph river basin is included because of its indirect concern with the lake. The Lake Michigan basin is of glacial composition with northerly drainage and topographical conditions producing creeks and small rivers. A number of these are described along with Burns Ditch construction. Greatest population is in northern Lake County with Primary Metal Industries employing 61.9% of the regions industrial workers. Water supply is judged to be adequate for some time with open water of Lake Michigan of excellent quality. Industrial wastes, municipal sewage and combined sewer overflows are principal pollution sources; the quality of major lakes, harbors, and rivers in the region is reviewed. Flooding is of limited importance and irrigation even less. Steam generation and the possibility of nuclear energy are closely related to water as is navigation especially with large industry. Watershed and recreation plans are reviewed with the Indiana Dunes especially important. Although less dense, the St. Joseph River with 408,130 in 1960 was almost two thirds as populous as the Lake Michigan basin. With numerous lakes, rivers and water at shallow depths water supply is no problem. Plans, criteria and standards regarding sewage treatment are reviewed; analyses have indicated poor river conditions at times. Although there are several dams in the region, most power is from fossil fuel with steam generation. (Preckwinkle-Chicago)
W70-09625

POLITICAL AND SOCIAL ACCOMMODATION AS A BASIC ELEMENT IN PLANNING.
Colorado State Univ., Fort Collins.
Norman Wengert.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John A. Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 55-71. 1 ref.

Descriptors: *Planning, *Administration, Social values, Attitudes, Political aspects.
Identifiers: *Political accommodation, *Social accommodation, Goals, Policy.

The need to approach political and social accommodation from a new viewpoint is enphasized. The concept of accommodation in planning has typically been approached from a negative viewpoint; i.e., accommodation implied non-rational action. Accommodation is seen in terms of flexibility of planning, the recognition of wider interests and views, and innovative planning. Planning can be thought of representing a kind of rationality in relating ends (a complex goal and value structure) to means, with the stress upon instrumental rationality and not on absolute sets of principles or conclusions. Motivation is also discussed as a factor stressing the need for accommodation in planning. Motives for executing a particular public program tend to be quite heterogeneous, a fact often overlooked by officials deeply involved in programs, who tend to think of public support as being unitary and with a single motive. A final consideration is the need to relate planning in the theoretical and conceptual sense to the realities of the democratic system. Problems such as different community goals in different social groups, disenfrancisement of minority groups, and lack of public institutions formulate and articulate public goals. (See also W70-09627). (Davis-Chicago)
W70-09626

COMPREHENSIVE WATER RESOURCE PLANNING: THE NEW APPROACH.
North Carolina Univ., Chapel Hill.
Maynard M. Hufschmidt.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 97-113.

Descriptors: *Planning, *Water resources, *Methodology, River basin development, Economic efficiency, Urbanization, Inter-agency cooperation.
Identifiers: *Comprehensive water resource planning, Economic development, Political equity, Environmental quality, Multi-sector planning.

Six major points regarding the status of comprehensive water resource planning are made. First, the present pattern of comprehensive river basin planning is not obsolete in many important respects. Second, the historical preoccupation with economic development as a rationale for water resource undertakings is much less important today than it once was. Third, in terms of plan formulation and analysis, the past concern for ecenomic efficiency as the single most important objective is being displaced by a concern for a broader set of objectives, e.g., equity and environmental quality. Fourth, the scale, scope, and content of water resource planning activities today are to some extent inadequate and obsolete, failing to deal with urban-metropolitan and urbanizing areas. Fifth, water resource planning must increasingly be carried out in a context of multi-sector planning. Sixth, water resource agencies must develop new patterns of working relationships with state and local agencies and with other federal agencies and programs. (See also W70-09629). (Davis-Chicago)
W70-09628

WATER RESOURCES PLANNING IN A METROPOLITAN NATION.
Georgia Inst. of Tech., Atlanta.
Guy J. Kelnhofer.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 185-190.

Descriptors: Urbanization, *Planning, Cities, Decision making, Political aspects, Water quality, Aesthetics, Institutions, Institutional constraints.
Identifiers: *Metropolitan water resource management, *Water resource planning, Metropolitan areas.

The United States has become an urban nation. As a result, the traditional governmental machinery and the set of assumptions and values which underlie it may not be applicable to the conditions of life in the modern metropolis. As a result, many new demands are being made upon water resources planning. First, a new measure of public investment decisions is how it affects people; and in what people can participate in the decision-making process. Second, urban interests rather than rural interests are the focus for water resources planning. Third, new considerations of water use are rising to prominence, considerations of quality and aesthetics. Fourth, change, flexibility, and responsiveness have become critical criteria in the public's evaluation of its management systems. Finally, agencies, such as the Corps of Engineers, will have to develop the ability to meet change confidently. To achieve this adaptability it is necessary to develop a highly-sensitive and smoothly-functioning internal planning capability. (See also W70-09630). (Davis-Chicago)
W70-09629

CHALLENGES OF THE URBAN METROPOLITAN ENVIRONMENT TO THE WATER RESOURCES PLANNER.
Chicago Univ., Ill. Center for Urban Studies.
John R. Sheaffer.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 191-201. 13 ref.

Descriptors: *Planning, *Water resources, *Urbanization, Cities, Education, Multiple purpose, Research and development.
Identifiers: *Metropolitan water resource management, Urban environment, Regional integration, Comprehensive planning, Chicago, Muskegon County, Michigan, Little Calumet River.

Three basic concepts are discussed in attempting to provide a basis for this discussion of metropolitan water resource management. First, metropolitan areas are defined as sociological units embracing the central city and the surrounding urban sprawl. Second, the potential roles of water resource planners are described. A planner's role is a multiple one: he can be an educator and provide technical assistance; he can be a catalyst, and imaginatively trigger programs and developments, some of which are usually thought of to be unrelated to water resource management; and he can be the manager, taking sole responsibility for managing water with very little influence from anyone else. Third, metropolitan water resource management is described by a set of characterizing concepts: public-private involvement, multi-purpose planning, multiple means programs, research to keep abreast of technological and social change, techniques of regional integration, and the incorporation of water resources planning into comprehensive planning. Three case studies are used to illustrate how water planning can be related to the urban picture: the Chicago deep tunnel project, the Little Calumet Basin, the Muskegon County, Michigan waste water plan. (See also W70-09631). (Davis-Chicago)
W70-09630

PROBING THE RELATIONSHIPS BETWEEN THE CHARACTERISTICS OF SOCIAL AND PHYSICAL SYSTEMS,
Colorado State Univ., Fort Collins.
Duane W. Hill, and Charles L. Garrison.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 219-234. 1 ref.

Descriptors: *Methodology, Social needs, Social aspects.
Identifiers: *Interdisciplinary studies, Social system, Physical system.

Attention is focused on a search for ways of obtaining better quality information which can be used to generate more adequate answers to pressing questions. A basic difficulty has been the isolation of the various physical science and social science disciplines from each other. Consequences which changes in the physical system may have for the social system, and vice-versa, remain largely outside the purview of scientific investigation. The state of the interdisciplinary art is discussed emphasizing the interdisciplinary needs of social science. Several characteristics of social investigators are analyzed including: non-technical and non-scientific character, non-systematic and impressionistic techniques, non-functional descriptive orientations, low interest and low skills in sophisticated data collection, and progress toward scientific development. The interdisciplinary researcher will find that the descriptive yields of the social analysts are the most plentiful and ready for use. He will also find that a solid basis for experimental investigation has been laid, and if that basis is developed thoughtfully and carefully, it will yield a highly useful body of information. (See also W70-09632) (Davis-Chicago)
W70-09631

COMMUNITY EDUCATION FOR PARTICIPATION IN WATER RESOURCE PLANNING,
San Mateo Coll., Calif.
J. William Wenrich.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 235-246. 3 ref.

Descriptors: *Planning, *Education, *Water resources, *Decision making, Communication, Social values.
Identifiers: *Water resource planning, *Citizen participation, Susquehanna River Basin Project, Public hearing procedure.

A basic problem in water resource planning is the meaningful involvement of local interests in the planning process and decision making regarding planning. The problem is complicated by the increasing technical complexity of the decisions to be made. Also, ther is often a failure to distinguish effectively between technical decisions and value judgments. Existing techniques, notably the public hearing procedure, have failed in many instances to develop meaningful public participation in the planning of water resource development. Meaningful citizen participation in water resource planning decisions depends on establishing more effective means for two-way communication between water resource agencies and the public during the planning process. Research in this direction is described utilizing the Susquehanna River Basin Project as a case study. (See also W70-09633) (Davis-Chicago)
W70-09632

THE IRON LAW OF ENVIRONMENTAL DISORDER: A PESSIMISTIC NOTE ON COMPREHENSIVE PLANNING,
Colorado State Univ., Fort Collins.
John A. Straayer.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 247-255. 7 ref.

Descriptors: *Planning, *Decision making, *Environment, *Methodology, Political aspects, Social aspects.
Identifiers: *Comprehensive planning, Environmental disorder, Environmental problems.

Comprehensive environmental planning has to do with devising methods and arrangements for controlling large portions of the environment. Given this definition, it is argued that comprehensive environmental planning is impossible. Emphasis should be placed on various levels of short term, lo-

calized and incremental muddling. There is an 'Iron Law' affecting decision making in the American political system which precludes effective solution of large scale environmental problems. Four interacting factors underlie this theory of environmental disorder: (1) the existence of multiple decision centers in the American political system; (2) the nature of contemporary environmental problems; (3) the nature of decision making in situations where demands outstrip resources; and (4) an ideology which supports local and decentralized decision-making prerogatives. As long asthese factors continue to exist, decisions which preclude comprehensive environmental planning will continue to be made. (See also W70-09626) (Davis-Chicago)
W70-09633

THREE APPROACHES TO ENVIRONMENTAL RESOURCE ANALYSIS,
Harvard Univ., Cambridge. Landscape Architecture Research Office.
Raymond K. Belknap, and John G. Furtado.
Available from the Conservation Foundation, Washington, D.C., 20036, Price: $2.00. Washington, D.C., Conservation Foundation, November 1967. 102 p, 21 fig, 43 ref.

Descriptors: *Planning, *Land management, *Land resources, *Land management, *Optimum development plans, Ecology, Multiple-purpose projects, Natural resources, Resource development.
Identifiers: Environment resource analysis.

This study selected three outstanding approaches developed to identify, analyze, and evaluate the natural and man-made resources that make up the physical environment and to outline their procedures. The three approaches examined are those expounded by G. Anous Hills, Philip H. Lewis, and Ian L. McHarg. More particularly, the study examined: (1) How the three individuals identified environmental and spatial patterns beyond single-factor analysis and simple spatial location; (2) how they identified and evaluated the key elements and forces that lend quality to the physical environment; (3) how they reviewed the analysis material for incorporation into the planning process; and (4) whether they treated environment as a resource per se or only in terms of the given planning purposes. (Davis-Chicago)
W70-09636

WATER PROBLEMS,
Geological Survey, Menlo Park, Calif.
H. E. Thomas.
Water Resources Research, Vol 1, No 3, p 435-445, Third Quarter 1965. 11 p, 2 tab, 14 ref.

Descriptors: *Water resources, Legal aspects, Political aspects, Technology, Environment, Constraints, Storage, Flow, Attitudes, Benefits, Costs, Management.
Identifiers: *Water problems, Physical constraints, Cultural constraints, Customs, Technological constraints, Socioeconomic problems, Economic constraints.

Man's effort to adapt to or modify his environment has generated water problems. As a first approximation the author classifies the constraints that cause these problems as follows: (1) Physical constraints, caused by the environment, specifically as it affects the storage and flow of water; (2) cultural constraints, resulting from customs and mores; (3) technological constraints, resulting from man's varying ability to modify his environment; (4) economic constraints, resulting from comparison of the benefits that may be received from water with the cost of realizing these benefits. Economic constraints become significant where there is choice among several alternatives of action. For example, choices must be made by administrators and consumers of water supplies as water becomes a scarce commodity in places where it had been previously abundant. Economic constraints may dictate the allocation of funds and other resources to water development. (Loeb-Rutgers)
W70-09648

THE THERMO-ECONOMICS OF SEA-WATER CONVERSION,
California Univ., Los Angeles.
Myron Tribus, and Robert Evans.
Water Resources Center Contribution No 61, Rept 62-53, 1963. 241 p, 44 fig, 21 tab, 32 ref, 8 append.

Descriptors: *Costs, *Fresh water, *Sea water, Technology, Flash distillation, Thermodynamics, Velocity, Conductors, Heat, Condensers, Vapor compression distillation, Freezing, Electrodialysis, Reverse osmosis, Equipment.
Identifiers: *Sea-water-conversion, *Optimum energy-technique, *Thermo-economics, Cost equation, Basic unit costs, Primary unit costs, Brine recycling, Load factor, Nonlinear systems, Conductance, Information theory, Multi-effect distillation, Solar energy, Available energy costs, Equipment costs, Expected value.

In this report, the economic and technological aspects of saline-water demineralization are set forth in concise form as they appear in the light of an intensive study of the underlying principles of thermodynamics and economics. These principles are digested into a compact technique which the authors call the 'optimum-energy-technique.' The optimum-energy-technique promises to be a faster, simpler, and surer method of studying and optimizing sea-water-conversion systems relative to other methods in current use. Application of the optimum-energy technique are given in this report for the following saline-water demineralization processes: multistage flash distillation, multi-effect distillation, vapor compression distillation, freezing, electro-dialysis, reverse osmosis, solar energy, and low-temperature-difference distillation. The optimum-energy-technique shows the relative importance of the many technological factors of sea-water conversion primarily according to their effects on two critical unit costs; the costs of available-energy and equipment, and the equipment conductance cost. The expected value of the latter cost may be used for judging the merits of various research proposals. The optimum-energy-technique should, via illuminating the combined economic and technological aspects of sea-water conversion, prove to be useful for planning or appraising systems of sea-water rectification. (Loeb-Rutgers)
W70-09653

NEW DIMENSIONS FOR TRANSNATIONAL MARINE RESOURCES,
Resources For the Future, Inc., Washington, D.C.
Francis T. Christy.
American Economic Review Vol LX, No 2, p 109-113, May 1970.

Descriptors: *Oceans, *Water resources, *Management, *Economic aspects, Continental shelf, Ocean circulation, Sea water, Water law, Fishing, Mining, Capital, Labor, Costs, Prices, Economic feasibility, Fisheries, Conservation, Economic impact.
Identifiers: *Exclusive rights, *property rights, Economic systems.

The author feels that the growing value of marine resources and the increasing incentive of nations to appropriate these resources makes the oceans a potential source of major conflict between states. Social scientists have an important role to play in the formulation of new rules and institutions governing the appropriation of the sea's resources. The paper studies the differences between resources of land and those of the sea. It is impossible to assign exclusive rights to the sea or to control the amounts of capital and labor applied to the resource. In the exploitation of the sea's resources there is a confrontation between economic units operating under different wage/price structures and different value systems. The difficulty of managing the sea's resources is explained as well as the problems posed by the occurrences of the resources in three dimensional space. The paper concludes with a statement stressing the urgency of an early solution to these problems. (Murphy-Rutgers)
W70-09655

INTRODUCTION TO THE ECONOMY AND CHARACTER OF THE WABASH BASIN,
Iowa Univ., Iowa City.
Ronald R. Boyce.
In: Regional Development and the Wabash Basin, p 9-45, University of Illinois Press, Urbana, 1964. 15 fig, 11 tab.

Descriptors: *Water resources, *Flood damage, Economics, Industries, Population, Employment, Water quality, Water utilization, Demand, Navigation, Recreation, Benefits, Costs.
Identifiers: *Wabash Basin, Urban activities, Traffic density, Water problems, Flood prevention.

This paper discusses general problems in the Wabash Basin, population characteristics, basic urban activities, and water resources. The discussion of the water resources of the Basin would be of interest to the water researcher in this area as well as other areas of the US. The author presents possible development plans for the area in addition to the navigational and recreation use of the water. Recreation appears to be a major water resource benefit which would be drived from water impoundments in the Wabash Basin. Flooding is a major water problem and presents a major reason for water resources development. However, the values of the many possible benefits from a water impoundment can only be determined by an investigation of potential water benefits and concomitant costs. Flood prevention measures and a discussion of future study needs conclude this paper. (See also W70-09657) (Loeb-Rutgers)
W70-09656

INDUSTRY AND WABASH BASIN DEVELOPMENT,
Illinois Univ., Urbana.
Howard G. Roepke.
In: Regional Development and the Wabash Basin, p 59-78, University of Illinois Press, Urbana, 1964. 11 fig, 1 tab.

Descriptors: *Industries, Economics, Maps, Employment.
Identifiers: *Wabash Basin, *Development, Economic growth, Manufacturing, Industrial development.

This paper presents a consideration of the role of manufacturing in the economy of the Wabash Basin. Industry is one of the leading means of support for the Basin, and it is likely that much of the opportunity for future economic growth lies in this field. The analysis in this paper takes two forms. First, largely by the use of maps, the present extent, distribution, types, and growth of industry in the Basin is examined. This illustrates the extent to which industrial development has already taken place. Second, as the Basin is not a completely self-contained unit, certain trends affecting manufacturing in the United States as a whole and their possible effect on further development in the Wabash Basin are presented. This information might be relevant to other river basins where multi-level economic development plans are under investigation. (See also W70-09658) (Loeb-Rutgers)
W70-09657

RECREATION AND WABASH BASIN DEVELOPMENT,
Illinois Univ., Urbana.
Alfred W. Booth.
In: Regional Development and the Wabash Basin, p 79-88, University of Illinois Press, Urbana, 1964. 1 fig, 1 tab.

Descriptors: *Recreation, Recreation demand, Regions, Demand, Planning, Recreation facilities.
Identifiers: *Wabash Basin, Regional development, Recreation development.

Modern programs of regional development, particularly those which are water-oriented, are giving increasing attention to outdoor recreation. This is a response to a demand created by a mobile, wealthy society, with much free time, which has come to regard opportunities for outdoor recreation as a necessary ingredient in a 'better way of life.' Thus, any area or regional development program today must plan to satisfy this need. Furthermore, if the region has the potential, the planning program should also include provisions for capitalizing on these assets by planning for recreation-centered economic activity. The Wabash Basin is in the category of regions in which there is not only a strong demand for recreation activity, but in which there is also a potential for recreational development which could satisfy regional needs as well as forming the basis for, at least, a modest recreational industry serving an extraregional market. (See also W70-09659) (Loeb-Rutgers)
W70-09658

SOME OBSERVATIONS ON THE BUDGET CONCEPT,
National Planning Association, Washington, D.C.
Gerhard Colm, and Peter Wagner.
Review of Economics and Statistics Vol 65, No 2, p 122-126, May 1963.

Descriptors: *Budgets, *Economic evaluation, *Decisionmaking, Government, Financing, Forecasting, Planning, Debt, Management, Costs, Benefits, Capital costs.
Identifiers: *Program analysis, *Financial analysis, *Program Budget, Capital Budget.

Various budget concepts are analyzed in the light of the different purposes a budget must serve. The National Budget in particular is dealt with but relevancy exists for the water resources area because observations on the different types of budgets needed for different purposes are applicable to any program subject to rigorous analysis. The author distinguishes three purposes of a budget; program analysis, financial analysis and economic analysis. For these purposes there is a need for a program budget, a statement of cash receipts and payments, and a national economic budget. The first type of budget is of most importance in water resources and the author discusses those characteristics of this budget that would increase the quality of decision making and provide a more efficient allocation of resources. (Murphy-Rutgers)
W70-09663

ON DIFFERENT METHODS FOR ALLOCATING RESOURCES,
Yale Univ., New Haven, Conn.
Martin Shubik.
Kyklos Vol XXIII, Fasc 2, p 332-337, 1970.

Descriptors: *Prices, *Resources, *Economic evaluation, *Distribution, Government, Economic efficiency, Resource development, Taxes, Costs, Resource allocation, Administration, Economic justification.
Identifiers: *Public goods, *Voting, *Market mechanism, *Externalities.

Price theory deals with the use of a price mechanism in solving the production and allocation of resources among a population. However, society must deal with the production and distribution of the product of jointly owned scarce resources within a society. For this purpose the price mechanism alone has been found to be deficient. This situation is faced by water resources as a public good. The author discusses eight different mechanisms which may be used for the allocation of resources: (1) The economic market with a price system. (2) Voting procedures. (3) Bidding. (4) Bargaining. (5) Allocation by higher authority, fiat or dictatorship. (6) Allocation by force, fraud or deceit. (7) Allocation by custom, including gifts and inheritance. (8) Allocation by chance. The analysis concludes that the problems of large-system implementation and of external economies and diseconomies point away from a larger functioning of the price system. The conclusion of this article is of general interest to theoretical research in the public good nature of water projects. (Murphy-Rutgers)
W70-09664

MICRODATA, ECONOMIC RESEARCH, AND THE PRODUCTION OF ECONOMIC KNOWLEDGE,
National Bureau of Economic Research, New York.
F. Thomas Juster.
American Economic Review Vol LX, No 2, p 138-148, May 1970.

Descriptors: *Optimization, *Research and development, *Economics, *Data collections, Statistics, Pollution, Cost, Government, Measurement, Income, Forecasting, Resource allocation, Social aspects.
Identifiers: *Microdata, *Economic research, Research design, Private returns.

An attempt is made to show that the generation of precise sets of micro-observations growing out of the analytical requirements of a specific research problem is likely to provide a much more promising method of expanding economic knowledge than the application of more sophisticated, analytical and statistical techniques to existing data. The author demonstrates the gap which exists between private and social returns to alternative research strategies which prohibits normal market forces from bringing about the necessary reallocation of research resources. The budgetary implications of the research strategy outlined are shown to be formidible with the most significant returns from that strategy not appearing for many years. The large amount of economic research being conducted in the water resource area could be aided by the application of the principles described in the article. (Murphy-Rutgers)
W70-09665

WATER-SUPPLY STRINGENCIES-FEATURES, ANTECEDENTS AND OBSTACLES TO RESOLUTION,
Geological Survey, Carmel, Calif.
Arthur M. Piper.
Boston College Industrial and Commercial Law Review, Vol 9, No 3, p 633-646, Spring 1968. 14 p, 34 ref.

Descriptors: *Water supply, *Water resources development, *Water law, Institutions, Governments, Legislation, Social aspects, Legal aspects, Economics, Water quality, Water yield, Water costs, Water shortage, Planning.
Identifiers: Water resources law.

It can generally be stated that present practices of water-supply management involve acquired habits some of which run counter to the realities of hydrology. These habits all too often take the form of policies and decisions which look towards selected effects rather than comprehensive objectives. Specifically, a resolution of foreseeable stringencies of supply must contend with illogical concepts for allocating available supplies among uses both present and prospective with circumscribed and, in many instances, inadequate institutional concepts, and with inflexible water law. It can thus be said that any success in resolving foreseeable stringencies at a still relatively early time--and thus precluding a later generation of more complex stringencies--may be measured in terms of breaks from traditional concepts and procedures. Solutions both bold in scale and novel in purpose are required. (Knapp-USGS)
W70-09852

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-A - SIM-I - PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09512

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-B - SIM-II PROGRAM DESCRIPTION.
Texas Water Development Board, Austin, Texas.
For primary bibliographic entry see Field 06A.
W70-09513

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-C - ALLOCATION PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09514

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE: VOLUME II-D - STAGE DEVELOPMENT PROGRAM DESCRIPTION.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09515

A COMPLETION REPORT ON SYSTEMS SIMULATION FOR MANAGEMENT OF A TOTAL WATER RESOURCE - VOLUME VI - RESEARCH ACCOMPLISHMENT AND COST SUMMARY.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06A.
W70-09519

INPUT-OUTPUT ANALYSIS OF WATER USE FOR NEBRASKA INDUSTRIES,
Nebraska Univ., Lincoln. Water Resources Research Inst.
A. W. Epp, and Maurice Baker.
Available from NTIS as PB-193 798, $3.00 in paper copy, $0.65 in microfiche. Technical Research Project Completion Report, August 1970. 15 p, 5 ref.

Descriptors: *Costs, *Irrigation, *Benefits, Nebraska, Analysis, Water rates.
Identifiers: Water productivity, Industry location.

The input-output analysis indicated that water was of minor importance to industry in deciding where to locate. Site selection by industry is based upon more important factors than water costs. A doubling of water costs for five heavy water using industries would increase cost of products less than one percent. Water costs in the meat packing and dairy processing industries were of minor importance. Those plants which purchased water from municipal water systems generally realized a greater productivity from water than those who had their own wells. The net benefits from irrigation with limited quantities of water were greatest when 21,000 acres were irrigated with direct stream diversion. Other alternatives considered were 21,000 acres with storage, 10,500 acres direct diversion. The net benefits ranged from minus (-) $128,000 for the 10,500 acres with storage to $284,000 for the 21,000 acres with direct diversion. The cost-supply study included three areas representing direc diversion, on-stream storage and off-stream storage types of projects. Nearly 65 percent of the water in the on-stream storage system was delivered to the farm while the other two

systems delivered only 52 to 53 percent of the water diverted. The cost per acre-foot of water supplied was $15.54, $20.33, and $22.58 for the direct diversion, off-stream storage and on-stream storage respectively. The on-stream storage system was able to deliver 0.072 acre-feet per dollar cost while the other two delivered 0.055 and 0.060 acre-feet per dollar cost for the off-stream storage and direct diversion respectively.
W70-09525

SOME ANALYTICAL RESULTS ON TAX DEPRECIATION,
American Telephone and Telegraph Co., New York.
Peter B. Linhart.
Bell Journal of Economics and Management Science Science Vol 1, No 1, p 82-112 Spring 1970.

Descriptors: *Depreciation, *Public utilities, *Government, *Economic evaluation, Mathematical studies, Taxes, Capital, Model studies, Debt, Rate of interest, Planning, Forecasting, Rate of discount, Costs.
Identifiers: *Accelerated tax depreciation, *Utility regulation, Firm growth rate, Flowthrough, Normalization, Rate of return.

This paper is an attempt to shed some light on the debate concerning the conflict between regulatory bodies and those utilities that would like to use accelerated tax depreciation as a source of working capital through normalization. It provides an analytical framework within which the effects of various depreciation policies on utilities, their customers and the Federal Treasury can be examined with some precision and generality. The main emphasis is on regulated utilities and the author shows that following a switch from straight-line book and tax depreciation to accelerated tax depreciation, with flowthrough, very substantial rate increases will always be required after a fixed interval, regardless of the firm's growth rate. Since most water utilities are of the regulated type described in the paper, the author's conclusions should be of interest to the water utility manager. (Murphy-Rutgers)
W70-09662

6D. Water Demand

INDUSTRIAL USE AND COMMUNITY SUPPLIES OF WATER IN ALABAMA,
Auburn Univ., Ala. Water Resources Research Inst
Donald R. Street, Robert R. Criss, Robert L. Burks, and James H. Baker.
Available from NTIS as PB-193 796, $3.00 in paper copy, $0.65 in microfiche. School of Business, Research Series I, January 1970. 111 p, 55 ref, 6 append. OWRR ProjectB-012-ALA (1).

Descriptors: *Water use, Industrial water, Water supply, Water allocation (Policy), Domestic use.
Identifiers: *Alabama, Alabama Water Improvement Commission.

This report identifies present and potential areas of conflict between water users in the State of Alabama. Even though at the present time there is an adequate supply of water for most industrial as well as community uses, the authors foresee major conflicts in the near future. They came to this conclusion after detailed study of water usage data collected from major industrial water users and from municipalities of over 100 persons in Alabama. Since Alabama has no comprehensive water resources usage law the authors urge the state legislature to evaluate water usage data and to formulate legislation which would lead to a more rational distribution and conservation of Alabama's water resources. (Holmes-Rutgers)
W70-09521

DEVELOPMENT OF INTERNATIONAL RIVER BASINS: REGULATION OF RIPARIAN COMPETITION,
For primary bibliographic entry see Field 06E.
W70-09776

6E. Water Law and Institutions

CITY OF NEWARK V DEP'T OF HEALTH (ADMINISTRATIVE DETERMINATION OF WATER POTABILITY).

109 N J Super 116, 262 A2d 718-725 (1970).

Descriptors: *New Jersey, *Standards, *Water quality control, *Administrative decisions, Regulation, Public health, Judicial decisions, Legal aspects, Legislation, Local governments, Political aspects, Public benefits, Public rights, Social aspects, State governments, Potable water, Water purification, Water quality, Water pollution, Turbidity, Reservoir storage, Water treatment, Water supply, Flocculation, Administrative agencies.

Defendant Department of Health ordered plaintiff city and nearby municipalities to build a water treatment facility which would elevate the purity of their mutual water supply to defendant's minimum standards. Plaintiff brought action for a declaratory judgement, contending that such standards exceeded the authority delegated to defendant by the legislature in that the legislature had conferred upon defendant authority to determine only standards of water potability. Plaintiff argued that such authority did not include the determination of requirements as to purity of color, degree of turbidity and the like. The court held that the statutory language of the legislature indicated a broad delegation of powers to defendant in the area of public health, including the specific authority to regulate the purity of potable water and to enforce such regulation by administrative order. Furthermore, when dealing with statutes that promote public health, courts traditionally apply a liberal construction regarding supervisory and regulatory powers. The only test is whether such acts are reasonably related to the ends sought. The court held that defendant's standards of purity easily met that test. (Clarke-Florida)
W70-09527

LAKE FRONT EAST 55TH ST CO V CITY OF CLEVELAND (SUBSEQUENT GRADUAL ACCRETIONS AS NOT AFFECTING BOUNDARIES DETERMINED UNDER TORRENS ACT).
36 NE2d 196-197 (Ohio Ct App 1961).

Descriptors: *Ohio, *Accretion (Legal aspects), *Boundaries (Property), *Shores, Real property, Land, Land forming, Judicial decisions, Remedies, Boundary disputes, Regulation, Standards, Movement, Fluctuation, Legal aspects, Cities, Local governments, Relative rights.
Identifiers: *Torrens Act.

Plaintiff corporation had previously initiated an action under the Torrens Act, seeking and receiving a decree in which the location, direction and approximate length of the shore line to his property was determined. In later years the shore line was advanced by gradual accretions. Plaintiff brought this action to acquire title to the accretive land, as well as to obtain a change of his boundaries. In a per curiam opinion, the court held that plaintiff's rights were limited to the lands within the boundary lines established by the Torrenization proceedings. The court stated that the established rule of law required that once boundaries had been determined under the Torrens Act, such boundary lines did not change and were not affected by subsequent events. (Finman-Florida)
W70-09547

DOWNES V CROSBY CHEMICALS, INC (PUBLIC RIGHT OF ACCESS UPON NON-NAVIGABLE CREEK).

234 So 2d 916-922 (Miss 1970).

Descriptors: *Mississippi, *Non-navigable waters, *Ownership of beds, *Public rights, Navigation, Streams, Riparian rights, Streambeds, Navigable waters, Banks, Judicial decisions, Beds under water, Relative rights, Access routes, Legal aspects, Boating, Usufructuary right, Legislation, Remedies, Bodies of water.

In an action to quiet title and enjoin a trespass, plaintiffs contended that defendants had no right to enter upon a creek, the bed of which was owned by plaintiffs. Defendants asserted that they, as members of the general public, had a right to enter the creek with boats. The court held that the general public has a right to enter upon public streams regardless of who owns the bed of such streams. However, a public stream is one which is navigable as defined by statute or one which is navigable in fact. No statute was here applicable and the evidence showed that the creek was a small stream with relatively little water and with numerous obstacles, drifts, and jams. The stream was not navigable in fact nor by statute and, as such, was not a public stream upon the general public had a right to enter. The decree permanently enjoining defendants from further trespass upon plaintiffs' creek was affirmed. (Snow-Fla)
W70-09553

BOSTON EDISON CO V GREAT LAKES DREDGE AND DOCK CO (DAMAGES FROM DREDGING OF NAVIGABLE RIVERS).
423 F2d 891-897 (1st Cir 1970).

Descriptors: *Dredging, *Navigable rivers, *United States, *Transmission lines, River beds, Powerline carriers, Channel improvement, Stream improvement, Rivers, Beds under water, Underground, Legal aspects, Remedies, Judicial decisions, Federal government, Projects, Communication, Electrical networks, Administrative agencies, Damages.

Plaintiff brought an action against the United States and its dredging contractor for damages to plaintiff's power cables under a navigable river. Plaintiff contended that defendants were negligent in conducting dredging operations. Plaintiff's cables had been installed under the river pursuant to a permit issued by the Secretary of the Army, who had been authorized by Congress to make regulations for the use of the navigable waters of the United States. The government contended that a provision of plaintiff's permit exculpated the government from liability for damages caused by operations of the government in improving navigation. Plaintiff argued that, in light of the enunciation of governmental policy in the waiver of sovereign immunity by the Federal Tort Claims Act, the insertion of such provision was beyond the power validly delegated to the Secretary. The court held that governmental immunity still existed as to discretionary acts and that the Secretary's decision to dredge was such a discretionary act. Thus, the disclaimer of liability by the Secretary did not contradict any governmental policy and was not in excess of his delegation to make regulations. The exculpatory provision being valid, the summary judgment dismissing plaintiff's claim against the government was affirmed. (Snow-Fla)
W70-09555

GARDEN CONSTRUCTION CO V UNITED STATES (ACTION FOR THE WRONGFUL TAKING OF PROPERTY WITHOUT COMPENSATION).
423 F2d 273-277 (Ct Cl 1970).

Descriptors: *United States, *Drainage, *Easements, *Eminent domain, Pipes, Judicial decisions, Legal aspects, Cities, Federal government, Local governments, Streams, Diversion, Roads, Road construction, Surface drainage, Drainage practices,

ainage systems, Drainage effects, Damages, ater management (Applied), Surface runoff, ains, Ditches.

fendant United States installed a drainage pipe its property which, pursuant to an approved n, discharged water into a county roadbed utting its land. Since the stream was eliminated m use, plaintiff, to provide drainage to the coun- pursuant to its obligations in the creation of an ustrial park, was required to grant the county an sement across other parts of its land and to lay peline to drain off water in the roadbed which d accumulated after being discharged from de- ndant's property. Plaintiff contended that defen- nt's acts which caused the water to accumulate d which required plaintiff to grant an easement d lay pipelines, amounted to a taking of its pro- rty without compensation. The court held that ce there was no direct invasion of plaintiff's land drainage water, since defendant was duly per- tted to empty water into the roadbed, and since ch water was carried away by pipes and a ainage easement which was compelled by the unty and not defendant, it could not be con- ded that plaintiff's costs and damages resulted m a taking by defendant of plaintiff's property. arnett-Fla)
70-09561

RISH OF JEFFERSON V UNIVERSAL EETING CO (RIPARIAN RIGHT TO USE OF NKS OF NAVIGABLE STREAM).
4 So 2d 88-93 (La Ct App 1970).

escriptors: *Louisiana, *Beds, *Banks, *Naviga- e rivers, Mississippi River, Regulation, Judicial cisions, Legal aspects, Levees, Riparian land, parian rights, Cities, Boats, Reasonable use, ores, Overflow, Public rights, Streams, Legisla- n, Administration, Usufructuary right, Zoning.
entifiers: *Batture land.

aintiff parish passed an ordinance zoning certain tture land for single-family residence. Defendant ased land on the batture for the purpose of moor- g its barges. Plaintiff brought suit to enjoin the mmercial use of the batture in violation of its or- nance. The lower court dismissed the suit, hold- g the ordinance to be unreasonable, arbitrary, d discriminatory. The appellate court affirmed. ne court stated that the use of the banks of vigable rivers is a public right. Everyone has a ee right to land and moor his vessels, although the nks belong to those who own the adjacent land. ne court held that the batture in question was thin the bank of the Mississippi River and that e riparian owner owned the batture subject to the rvitude of public use, i.e. that use which is in- dent to the nature and navigational character of e stream. The riparian owner could use the bat- re in any reasonable manner, provided he did not riously obstruct or impede the public use of the nks. The restriction of the batture to use as a sin- e-family residence was an unconstitutional use of e zoning power in conflict with the laws of the ate. (Barnett-Fla)
70-09591

HERMAL STANDARDS IN THE UNITED TATES OF AMERICA,
ederal Water Pollution Control Administration, uluth, Minn. National Water Quality Lab.
or primary bibliographic entry see Field 05G.
70-09595

ILL V PORTER (PROPERTY LINES OF IPARIAN LANDOWNERS ON OPPOSITE IDES OF ABANDONED RIVERBED).

50 SW2d 306-308 (Ark 1970).

escriptors: *Arkansas, *Avulsion, *Boundaries Property), *Ownership of beds, Soil erosion, iver beds, Navigable rivers, Non-navigable aters, Valleys, Topography, Cutoffs, Riverflow, Thalweg, Accretion (Legal aspects), Boundary disputes, Real property, Dredging, Banks, Judicial decisions, Land tenure, Riparian land, Riparian rights.

As a result of a cut-off dredged by the Army Corps of Engineers, the Arkansas River abandoned its original channel. A boundary dispute arose between the riparian landowners on opposite sides of the abandoned river channel. Plaintiff landowner contended that the boundary should be a line through the channel equidistant from the channel's banks. Defendant landowner contended that the boundary should have been fixed along the thalweg of the river at the moment it became nonnavigable. The trial court accepted plaintiff's contention. On appeal, the Supreme Court of Arkansas stated that the state's title rests on navigability, and once the navigability ceases, the rights of the riparian owners attach to the beds. The court also cited with approval a previous United States Supreme Court decision wherein it was stated that when a river channel is changed by accretion, the boundary follows the course of the stream, but if the change is caused by avulsion, the boundary remains in the middle of the old channel. The court, in reversing the trial court, held that here the channel alteration was caused by avulsion, and once the river became non-navigable, the boundary line should have been fixed along the thalweg of the abandoned channel. (Price-Fla)
W70-09598

CITIZENS COMM FOR HUDSON VALLEY V VOLPE (AUTHORITY TO ISSUE PERMITS FOR CAUSEWAY CONSTRUCTION).
425 F2d 97-107 (2nd Cir 1970).

Descriptors: *Hudson River, *Permits, *Federal government, *Administrative decisions, Highway effects, Bridge construction, Remedies, Rivers and Harbors Act, Environmental effects, Highways, Landfill, Dredging, Conservation, Water law, Legal aspects, Dikes, Natural resources, Recreation, Aesthetics, Administrative agencies, Judicial decisions.
Identifiers: *Army Corps of Engineers, Causeways.

Plaintiff citizen groups brought actions to enjoin defendant Army Corps of Engineers from issuing a permit authorizing the state to conduct a dredge and fill operation for an expressway project and to revoke the state's existing permit. Plaintiffs contended that the proposed expressway would adversely affect the local environmental and scenic resources and that the Corps of Engineers had exceeded its authority in approving the project since it contained dikes and causeways, which, by federal statute, could not be constructed without the consent of Congress and the approval of the Secretary of Transportation. Defendant argued that plaintiffs had no standing and that the Corps of Engineers did not have to consider the necessity of further federal approval before acting. The court held that civic groups concerned with preservation of natural, scenic and historic resources had standing to seek review of the Corps' decision. The court further held that the Corps of Engineers could not ignore the prospect of future federal approval. The court affirmed the district court's order revoking the state's dredge permit and enjoining issuance of a new permit without first obtaining the consent of Congress and the approval of the Secretary of Transportation. (Liptak-Fla)
W70-09600

UNITED STATES V CERTAIN LAND IN THE COUNTY OF WORCESTER, STATE OF MARYLAND (VALUATION OF EASEMENTS IN CONDEMNATION SUIT).

311 F Supp 1039-1059 (D Md 1970).

Descriptors: *United States, *Maryland, *Easements, *Condemnation value, Condemnation, Compensation, Eminent domain, Economic impact, Beaches, Coasts, Shores, Harbors, Piers, Coastal structures, Docks, National parks, Federal government, Parks, Public lands, Land use, Judicial decisions, Legal aspects, High water mark, Low water mark.

The United States, plaintiff in condemnation suits brought for the establishment of a national park on an island off the coast of Maryland, sought to value certain reserved easements as nominal. Defendants, trustees of a liquidated landowners' corporation formed by the original individual owners of the island, argued that the easements were of more than nominal value. The easements included private use of the beach by members of the corporation, reservation of certain sites for a pier, a fuel dock, and a harbor site. The United States District Court of Maryland held that beach front property may be privately owned only to the high water mark, that the portion of the beach between high and low water marks is owned by the state for public use, and therefore that easements for the private use of the beach were only of nominal value. However, the remaining reserved commercial easements were held to be of more than nominal value. (Barker-Fla)
W70-09601

LAKE MICHIGAN BASIN STUDY: MICHIGAN SECTION.
League of Women Voters of Michigan, Detroit.
For primary bibliographic entry see Field 06B.
W70-09622

LAKE MICHIGAN BASIN STUDY-ILLINOIS SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.
For primary bibliographic entry see Field 06B.
W70-09623

LAKE MICHIGAN BASIN STUDY: WISCONSIN SECTION.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.
For primary bibliographic entry see Field 06B.
W70-09624

LAKE MICHIGAN BASIN STUDY: INDIANA SECTION-1.
League of Women Voters, Detroit, Mich. Lake Michigan Inter-League Group.
For primary bibliographic entry see Field 06B.
W70-09625

INTERESTS AND INTEREST GROUPS IN THE WATER POLICY PROCESS.
Colorado State Univ., Fort Collins.
Daniel M. Ogden.
In: Focus on Change: Intergovernmental Relations in Water Resources Planning, John Straayer, editor, Policy Science Paper No. 1, Department of Political Science, Colorado State University, Fort Collins, Colorado, January 1970, p 77-95.

Descriptors: *Political aspects, *Water resources, *Planning, *Resource development, Preservation, Institutions, Decision making, Regulation.
Identifiers: *Water resource policy, *Interest groups, Water resource politics, Pressure group system, Conflict resolution, Policy.

Politics is the critical ingredient in natural resources development decisions. Good engineering plans and economic analysis can determine whether a development is possible but politics decides whether it will be done. Water resource politics has been primarily interest group politics. Water issues are rarely settled on partisan political grounds. Water resources politics in the United States is based on two political foundations, the American political party and the pressure group system. The important characteristic of political parties is that they are based on consensus and compromise and as such are diffuse in direction

and goals. Three types of pressure groups, or political groups not seeking office, can be identified: service groups, political action groups, and goal groups. Pressure groups base their activity on the successful exploitation of access to political power holders. Three different thrusts in water politics are identified: a preservation thrust, a development thrust, and a regulationist thrust. A key to understanding politics in water resources decision-making is viewing politics as a process of conflict resolution. (See also W70-09628). (Davis-Chicago)
W70-09627

QUALITY OF THE URBAN ENVIRONMENT: THE FEDERAL ROLE,
Urban Inst., Washington, D.C.
Elizabeth H. Haskell.
The Urban Institute Publication 102-6, Washington, D.C., May 1970. 78 p, 4 graphs, 3 charts, 1 append.

Descriptors: *Federal government, *Planning, *Administration, *Institutions, Standards, Resource allocation, Regulation, Inter-agency cooperation, Coordination, Institutional constraints, Political aspects, Technology, Population.
Identifiers: *Urban environment, *Environmental quality, *Policy, Environmental problems, Resource policy, Goal, Urban ecology.

A number of recommendations are made regarding the role of the federal government in maintaining the quality of the urban environment. (1) National resource policy will benefit more people if its rural resource orientation is changed to an emphasis on scarce urban resources; air, water, and open space. (2) A comprehensive environmental quality policy stressing the following is needed: (a) study and publicize the interdependency of environmental systems, (b) reduce duplication of federal environmental quality activities and promote rational allocation of resources among the several programs, (c) assure that various environmental quality standards, planning and subsidy programs mesh, and (d) set a framework for identifying and managing the conflicts between environmental quality activities and environmental uses that substantially affect that quality, sponsored either by the public or private sectors. (3) Federal agency organization should reflect the following: (a) programs structure should match the structure of the problem, (b) programs involving similar goals can often profit from administrative proximity, (c) an organizational structure should promote administrative efficiency, and (d) organizational changes should take account of political realities. (4) Regional management of the environment is necessary to effectively deal with environmental problems. (5) Careful attention needs to be paid to the development of clear policy goals. (6) A prevention strategy rather than a reaction strategy is necessary. (7) A review of new technology would provide new insights into future problems. (8) A rational population policy has become a necessity and (9) An understanding of urban ecology must be developed. (Davis-Chicago)
W70-09635

ARNOLD'S INN, INC V MORGAN (PRESCRIPTIVE RIGHT TO FORESHORE BECAUSE OF LANDFILL).

310 NYS2d 541-550 (Sup Ct 1970).

Descriptors: *New York, *Landfill, *Ownership of beds, *Prescriptive rights, Shores, Marinas, Intertidal areas, Riparian rights, Local governments, Easements, Judicial decisions, Public lands, Public rights, Land tenure, Water law, Adjudication procedure, Relative rights, Remedies, Navigation, Fishing, Swimming, Access routes, High water mark, Low water mark
Identifiers: *View, Injunction (Mandatory)

Plaintiff restaurant owner sought an injunction to compel defendant marina operator to remove landfill which alledgedly cut off the restaurant patrons' view across the bay and thereby interfered with plaintiff's riparian rights. Plaintiff town filed action against the marina operator claiming the landfill trespassed upon the publicly owned shore. After reviewing the nature of the jus publicum, the right of the public to navigate the waters over the foreshore, and the jus privatum, the right of the foreshore's owner, the court dismissed plaintiff restaurant owner's claim, finding that plaintiff's riparian rights included access to the water for navigation, fishing, and bathing, but not an easement of view. As to the plaintiff town, defendant contended that he had acquired title to the public land by prescription. However, the town argued that there could be no adverse possession against a governmental authority. The court held that prescriptive rights may arise against a town where the land is alienable as was the case here; however, the evidence refuted defendant's possession of the land for the requisite prescriptive period. The court therefore granted the relief sought by the town and ordered defendant to remove the landfill. (Liptak-Florida)
W70-09638

WHY A NATIONAL WATER COMMISSION,
National Water Commission, Washington, D.C.
Theodore M. Schad.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 2, Fall-Winter 1969-70, p 26-31. 5 photo.

Descriptors: *Water policy, *Water resources development, *Water management, *Planning, *Environmental effects, Economics, Socail aspects, Aesthetics, Administration, Legislation, History, Water conservation, Water demands, Water utilization, Water quality, Institutions.
Identifiers: *National Water Commission, Policy decisions, National water program, Alternatives.

Changes in national water policy are needed to assure that new demands for water will be met and to place limits on irreparable damage to our environment. The Nationa Water Commission was established to review present and anticipated rational water resource problems and alternative solutions. Advantages and disadvantages of solutions are studied with consideration of the economic and social consequences of water resources development on regional growth, on institutional arrangements, and on aesthetic values. The National Water Commission has outlined four general study areas as background for its deliberations and policy recommendations: (1) delineation of future problems and needs, (2) appraisal of existing water activities, (3) consideration of ways to improve existing institutions, and (4) analysis of objectives for the national water program. The article includes a resume of the history of the National Water Commission and its members, and a discussion of the authorizing legislation. Descriptions of the kinds of reports and studies presently being undertaken are given. It is hoped that the Commission's report and recommendations will be helpful in implementation of water policy decisions that reflect national objectives and that will not merely provide a program for economic development of the Nation's water supplies but will, also provide a program that protects the quality of the environment. (Marriott-Chicago)
W70-09641

THE CONSTRUCTION OF TRUST: AN EXPERIMENT IN EXPANDING DEMOCRATIC PROCESSES IN WATER RESOURCES PLANNING,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
Spencer W. Havlick.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 2, Fall-Winter 1969-70, p 13-19. 4 photo.

Descriptors: *Water management, *River-basin development, *Water resources development, *Planning, Community development, Institutions, Decision making, Methodology, Attitudes, Evaluation.
Identifiers: Susquehanna Experiment, Susquehanna River Basin, Atlantic Coast.

An experiment by the Corps of Engineers designed to improve trust in agency activities through increased communication and citizen participation in a multi-state comprehensive river basin planning study. Two major objectives of the Susquehanna experiment were: (1) to formulate alternative development and management strategies and present these to the public for preliminary consideration and (2) to incorporate preferences, or additional suggestions, of the 'recipient' citizenry in plans to accomodate the present and projected water-related needs. The research design and methodology sought first to identify the 'water resource influentials' in each county and community studied. These people were then involved in information workshops and public forums. The format of these workshops and forums is discussed in detail. Preliminary findings are given. The workshops were effective in directly influencing the planning staff, especially on localized adjustments. There were problems in differentiating between technical decisions and value judgments regarding the desirability of various alternative solutions. In conclusion, the engineering profession needs, in general, to create a greater sensitivity to citizen expectations in water resource planning. (Marriott-Chicago)
W70-09642

WATER PLANNING: MAKING A MESH OF THINGS,
Water Resources Council, Washington, D.C.
Henry P. Caulfield, Jr.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 1, p 27-29, Summer 1969.

Descriptors: *Water Resources Planning Act, *Water management, *River basin development, Water resources, Assessments, Evaluation, Water conservation, Water utilization.
Identifiers: *Water Resources Council, Coordination.

The structure, functions, and activities of the Water Resources Council, established under the Water Resources Planning Act, are described. Principle members of the Council are the Secretaries of the Interior; Agriculture; the Army; Health, Education, and Welfare; Transportation; and the Chairman of the Federal Power Commission. Associate members are the Secretary of Commerce and the Secretary of Housing and Urban Development. Other Agency heads are asked to participate when topics touch on their responsibilities. Council functions are: (1) to maintain a continuing study and make a periodic assessment of the adequacy of the Nations' water supply; (2) to establish principles, standards and procedures for Federal participation in the preparation of comprehensive regional or river basin plans--and for the formulation and evaluation of Federal water and related land resources projects; (3) to review comprehensive river basin plans prepared by river basin commissions or interagency committees and transmit them together with the Council's recommendations, to the President for transmittal to Congress. Actions initiated as a result of these functions are given in some detail. (Marriott-Chicago)
W70-09643

WATER POLLUTION: GREATER CALUMET AREA-INDIANA-ILLINOIS.
League of Women Voters of Chicago, Ill.
For primary bibliographic entry see Field 05G.
W70-09647

SKOWYSZ V CITY OF VENTNOR (RIGHT OF CITY TO SELL PUBLIC BEACH).

110 N J Super 340, 265 A2d 554-561 (1969).

Descriptors: *New Jersey, *Beaches, *Accretion (Legal aspects), *Public lands, Cities, Legislation, Governments, Planning, Public benefits, Public

ights, Legal aspects, Water law, Coasts, Sands, hores, Recreation facilities, Bulkhead line, Jetties, ulkheads, reclamation, Coastal structures, Judi- ial decisions, Local governments.

laintiff taxpayers brought suit against defendant ity to set aside an ordinance authorizing the sale of ertain beach front land. Plaintiff also sought to en- oin the sale of the land. Plaintiffs argued that the nd in question was held by the city for public use s a recreation area and, as such, could not under, ew Jersey statute, be sold. Defendant argued that proposed plan for the construction of jetties ould through reclamation create new land below ie existing bulkhead and that the existing beach roperty would no longer be needed for public use. his, it was contended, exempted the sale from the atutory prohibition. The Superior Court of New ersey, reviewing a trial court decision for defen- ant, held that the proposed creation of new beach d not constitute reclamation, but was accretion, us falling outside of the statutory authority for le by a municipality of land no longer held for the ublic. The court ruled that reclamation contem- ates the construction of a new bulkhead and a lling-in of land, whereas accretion is merely an ad- tion to existing shore line. (Barker-Florida) 70-09650

NITED STATES V LOUISIANA (TEXAS OUNDARY CASE).
3 Am J Int'l L 837-838 (1969) 2 p, 8 ref.

escriptors: *Texas, *Boundary disputes, *Owner- ip of beds, *Submerged Lands Act, Boundaries Property), Federal government, Federal jurisdic- on, International law, Judicial decisions, Legal spects, Legislation, Relative rights, State govern- ents, State jurisdiction, Erosion, Accretion Legal aspects), Federal-state water rights con- cts, Gulf of Mexico.
entifiers: *Seabeds.

he Submerged Lands Act of 1953 granted to the ate of Texas lands under the Gulf of Mexico ex- nded outward from its coastline for 9 miles. The spute arose as to whether Texas' present coast- ne configuration should be used to determine the mile boundary limitation or whether the coastline at existed in 1845 when Texas was admitted to e Union should be used. The Supreme Court held at the term 'coastline' as used in the Act must ean the modern ambulatory coastline defined in e 1958 Convention on the Territorial Sea and the ontiguous Zone. The court stated that any in- quitable results derived from a consistent applica- on of the scheme which Congress fashioned. Con- quently, Texas would have to look to Congress id not the courts for relief from such results. Clarke-Florida) 70-09651

HORT COURSE ON LEGAL ASPECTS AND ESPONSIBILITIES FOR ALLOCATION OF ATER RESOURCES (FEDERAL LAW OF ATER RESOURCES).

aho Water Resources Institute, Division of Con- nuing Education, Univ of Idaho (June 1969).

escriptors: *Idaho, *Federal government, *Ad- inistrative agencies, *Water resources develop- ent, Federal Power Act, Federal-state water ghts conflicts, Administration, Regulation, ederal jurisdiction, State jurisdiction, Water esources Research Act, Federal Reclamation aw, Hydroelectric project licensing, Project pur- oses, Legislation, Judicial decisions, United ates, Recreation, Fishing, Wildlife conservation, ater pollution control, Water resources, Manage- ent, Water conservation.
entifiers: Constitutions.

he primary concern of this series of individual apers and speeches is to examine in detail the con- itutional, statutory, decisional and administrative pects of both Idaho surface water law and federal water resources law. Considerations of federal law include: (1) federal water rights on public domain; (2) constitutional powers with respect to water rights and regulation; (3) relative state and federal jurisdictions over fish and wildlife; and (4) Federal Power Commission responsibilities under the Federal Water Power Act. In the area of water resources development and management, the functions, responsibilities, organization and activities of the following federal bodies are outlined: (1) U.S. Farmer's Home Administration; (2) U.S. Soil Conservation Service; (3) U.S. Agricultural Research Service; (4) U.S. Economic Research Service; (5) U.S. Bureau of Outdoor Recreation; (6) Federal Water Pollution Control Administration; (7) Federal Power Commission; (8) U.S. Army Corps of Engineers; (9) U.S. Forest Service; (10) U.S. Geological Survey; (11) U.S. Bureau of Land Management; (12) U.S. Bureau of Reclamation; (13) U.S. Office of Saline Water; (14) U.S. Environment Science Services Administration; (15) U.S. Fish and Wildlife Service; and (16) U.S. Office of Water Resources Research. (Marsee-Florida)
W70-09654

THE EXECUTIVE FUNCTION IN WATER RESOURCES PLANNING,
Delaware River Basin Advisory Committee, Trenton, N.J.
Walter M. Phillips.
In: Regional Development and the Wabash Basin p 157-165, University of Illinois Press, Urbana, 1964.

Descriptors: *Planning, *Water management, Water resources development, River basins, Delaware, Water resources, Governments, Local governments, State governments, Federal governments.
Identifiers: *Executive function, Political jurisdiction.

The thesis of this paper is that the executive role is essential in water resource planning, management, and development. The fact of multiple political jurisdictions exercising authorities over interstate rivers, coupled with normal complexities of three-level government-local, state, and federal-and further coupled with the diffusion of agencies dealing with water at both the state and the federal levels, has frustrated the executive process required for coherent dealing with water in many such river basins. To establish this point systematically would require an exhaustive treatise. This paper illustrates the water problems of the Delaware and describes the new governmental machinery created by the inter-state federal compact for the exercise of certain executive, quasi-judicial, and quasi-legislative functions relating to the waters of the Delaware. (See also W70-09656) (Loeb-Rutgers)
W70-09659

TOWN OF HEMPSTEAD V OCEANSIDE SMALL CRAFT MARINA, INC (ACTION BY TOWN TO RECOVER FAIR RENTAL VALUE OF ITS UNDERWATER LANDS USED BY DEFENDANT MARINA).

311 NYS2d 668-674 (Sup Ct 1970).

Descriptors: *New York, *Cities, *Marinas, *Beds under water, Rent, Recreation facilities, Boats, Docks, Inland waterways, Navigable waters, Leases, Ownership of beds, Riparian rights, Legal aspects, Judicial decisions, Access routes, Riparian land, Recreation, Structures, Piers, Tidal effects, Silting, Permits.

Plaintiff town sought to charge rent for defendant marina's use of underwater land belonging to the town. Because the marina owned the riparian land adjacent to the town's beds, it claimed the right to use the beds without rent as a matter of riparian right. The court held that the town could not charge rent for its underwater lands which were used primarily for access from defendant's docks to its upland riparian property. However, the court found that the operation of the marina in charging rent for the use of its docks and other facilities was a distinct activity. The town was therefore entitled to charge rent for that portion of its beds which were being used to support a commercial docking activity. Emphasizing that the case in no way impinged upon the right of the town to require a permit for the use of its property, the court held the town entitled to fair rental. (Caldwell-Florida)
W70-09670

KNOX COUNTY V MONCIER (INVERSE CONDEMNATION SUIT BROUGHT BECAUSE OF FLOODING CAUSED BY HIGHWAY CONSTRUCTION).
455 SW2d 153-158 (Tenn 1970).

Descriptors: *Tennessee, *Condemnation, *Flooding, *Highway effects, Damages, Road construction, Drainage, Highways, Flood damage, Floods, Land use, Legal aspects, Remedies, Drainage patterns, Payment, Judicial decisions, Legislation, Administrative agencies, Flooding, Land tenure.
Identifiers: *Inverse condemnation.

After the initiation of construction of a nearby highway, plaintiff's property was flooded. The State Highway Department subsequently made an effort to improve the drainage of plaintiff's land, but the property was later flooded again. Plaintiff filed suit seeking inverse condemnation of the property, claiming that the highway's alteration of his land's drainage patterns had made it unusable. Defendant county argued that the statutory one-year limitation on such suits began to run on the date of the original flooding and that plaintiff's suit was therefore barred. The court rejected this argument, holding that in view of the work done by the Highway Department after the first flood, the plaintiff could reasonably have thought the injury only temporary. The statute was triggered only when plaintiff knew or should have known that the injury to his property was permanent. The court held that this knowledge was not chargeable to plaintiff until after the second flood, and that his suit was not barred by the statute of limitations. (Caldwell-Florida)
W70-09676

STATE V JOHNSON (STATUTE RESTRICTING USE OF PLAINTIFFS' MARSHLAND HELD UNCONSTITUTIONAL).

265 A2d 711-717 (Me 1970).

Descriptors: *Maine, *Legislation, *Wetlands, *Land development, Marshes, Administrative agencies, Remedies, Land use, Landfills, Conservation, Legal aspects, Coastal marshes, Shore protection, Judicial decisions, Relative rights, Zoning, Reasonable use, Natural resources, Land classification, Property values, Land tenure.
Identifiers: *Constitutionality, *Police power.

A Maine conservation statute severely restricted the use which could be made of coastal wetlands. When plaintiffs' application to fill their marshlands for commercial development was denied, they sought to have the statute declared unconstitutional. The court found that the procedures provided by the statute were not deficient, but that the act as applied to defendants was an unreasonable exercise of the police power. The court found that the land was valueless without the requested fill. It was reasoned that to leave plaintiffs with commercially valueless land in order to uphold the restrictions imposed by the statute would be to charge plaintiffs with more than their just share of the cost of the statewide conservation program. The deprivation of reasonable use of plaintiffs' land was held unconstitutional. (Caldwell-Florida)
W70-09700

PUBLIC ACCESS TO BEACHES,
Steve A. McKeon.

Stanford Law Review, Vol. 22, p 564-586 (1970). 22 p, 135 ref.

Descriptors: *Beaches, *Public rights, *Access routes, *Recreation demand, Land tenure, Beneficial use, Recreation, Public benefits, Seashores, Intertidal areas, Littoral, Easements, Land use, Administrative agencies, Regulation, Land development, Legal aspects, Judicial decisions, Legislation, Prescriptive rights, Right-of-way, Social aspects, Relative rights.

Private ownership of beaches often conflicts with increasing public need for beach recreation areas. Intertidal portions of beaches are universally publicly owned, but the dry-sand areas are the desirable areas for recreation. Public rights can be established in privately owned beach property by the creation of beach parks through condemnation or through creation of easements into the dry sand beach area. Subdivision exactions offer one method of easement creation; beachfront developers can be required to dedicate a portion of the property to public use in the same manner as such developers are required to dedicate property for use as streets. In litigation to confirm rights based on public use, courts have generally favored recognition of the public right of access. Theories of implied dedication through the owner's inaction in the face of continued public usage have been employed. California courts have required only 5 years of public use to create an implied dedication. The common-law doctrine of customary rights has also been used in this regard. (Caldwell-Florida)
W70-09775

DEVELOPMENT OF INTERNATIONAL RIVER BASINS: REGULATION OF RIPARIAN COMPETITION,
Nitza Shapiro-Libai.
Indiana Law Journal, Vol. 45, p 20-55 (1969). 35 p, 127 ref.

Descriptors: *River basin development, *International law, *International waters, *Water resources development, River basins, International commissions, Governments, Riparian land, Treaties, Water allocation (Policy), Natural resources, Legal aspects, Relative rights, Water rights, Water utilization, Competing uses, Consumptive use, International Joint Commission, Equitable apportionment, Water demand, Priorities, Adjudication procedure, Political aspects.

Because of disagreements between nations, many river basins which straddle international boundaries remain underdeveloped, even though the technological tools for development are available. The author contends that the function of international law in this area should be to transfer to the legal plane the level of achievement attained on the technical plane. Outmoded oncepts of territorial supremacy and integrity hamper international river basin development. The territory supremacy principle gives each nation exclusive jurisdiction over the segment of the river within its boundaries. The territorial integrity principle is the opposite side of the coin, each nation being prevented under international law from altering the natural conditions within its own territory to the injury of a neighboring nation. The author argues that the best approach is to consider the river basin as a unit, using the principle of equitable apportionment to allocate water among nations sharing the river basin. Competing uses could thus be reconciled. International commissions could act as adjudicating agencies, and the peaceful development of water resources would be aided. (Caldwell-Florida)
W70-09776

THE FEDERAL-STATE OFFSHORE OIL DISPUTE,
James W. Corbitt, Jr.
William and Mary Law Review, Vol. 11, p 755-770 (1970). 15 p, 122 ref.

Descriptors: *Oil, *Federal jurisdiction, *State jurisdiction, *Ownership of beds, Continental shelf, Exploitation, Oil industry, Legal aspects, Judicial decisions, Submerged Lands Act, Coasts, Permits, Law of the sea, Legislation, Political aspects, Resource development, Resource allocation, Income, Leases, Boundaries (Property), Beds under water.

The ownership of offshore ocean beds has been historically a source of dispute between federal and state governments. Supreme Court cases awarding all ownership rights to the federal government were overruled by Congress when the Submerged Lands Act was passed. This act vested ownership of the beds, to a distance of at least three miles, in the coastal states. However, this Act has not resolved the difficulty as no feasible method of drawing a line between state and federal ownership has been devised. The author contends that no such 'absolute' solution is possible. The solution suggested by the author is one of wealth division, whereby the revenues derived from the exploitation of the offshore beds would be divided between the state and the federal governments. The underlying cause of the ownership dispute is the desire of each level of government to retain for itself the revenues from the seabed, and an equitable division of these revenues would accomplish a feasible solution. (Caldwell-Florida)
W70-09777

THE SOURCE AND SCOPE OF PUBLIC AND PRIVATE RIGHTS IN NAVIGABLE WATERS,
Leighton L. Leighty.
Land and Water Law Review, Vol. 5, p 391-440 (1970). 50 p, 224 ref.

Descriptors: *Navigable waters, *Public rights, *Federal jurisdiction, *Water rights, Non-navigable waters, Recreation, Riparian rights, Prior appropriation, Tidal waters, Ownership of beds, Legal aspects, Judicial decisions, Navigable rivers, Transportation, Treaties, Admiralty, Recreation, Inland waterways, Land tenure, Federal government, State jurisdiction, Regulation, Usufructuary right, Federal-state water rights conflicts.
Identifiers: *Constitutions.

The federal test of navigability is whether the body of water in question is in fact navigable or suitable for reasonable commercial use. Federal jurisdiction prevails over state control if the body of water is considered navigable, and this can make considerable difference in allocation of public and private rights. Federal controls over navigable waters have been exercised in areas of legitimate national concern. The federal test for navigability is mandatory only where ownership of beds of navigable waters is determinative. State owned beds may be disposed of under state law. Rights tg surface use, as opposed to bed ownership, is generally determined by state law. The author contends that the navigability test of determining private and public rights may well have outlived its usefulness. The general welfare, war powers, and commerce clause provisions of the Constitution give Congress an adequate base for jurisdiction over waters important enough to warrant national control. Determination of rights as to other waters should be left to state law. (Caldwell-Florida)
W70-09778

THE TRANSFER OF WATER RIGHTS FOR USE IN THE OIL INDUSTRY,
Paul S. Galeotos.
Land and Water Law Review, Vol. 5, p 441-448 (1970). 8 p, 32 ref.

Descriptors: *Water rights, *Industrial water, *Water utilization, *Oil industry, Riparian rights, Prior appropriation, Competing uses, Beneficial use, Leases, Land tenure, Water allocation (Policy), Economics, Priorities, Water contracts, Legal aspects, Natural flow doctrine, Diversion, Reasonable use, Water demand, Judicial decisions, Riparian land, Remedies, Consumptive use.

The author of this comment contends that water rights must be made freely transferable in order to stimulate industrial growth. Otherwise new industries will be unable to obtain needed water. In states following the prior appropriation doctrine unappropriated water may be acquired by complying with appropriation statutes. Generally, a lessee may appropriate water rights. In any case, the appropriation must be for a beneficial purpose. Where waters are already appropriated, reallocation problems arise. Resource developers may often purchase water rights from a prior appropriator and change its use--subject only to state law and to the rights of superior appropriators. Statutes unduly restricting change of use hamper industrial development. In riparian-rights states which follow the natural flow doctrine, any substantial withdrawal from a stream is enjoinable by downstream owners. The reasonable use doctrine of riparian law is more flexible. In view of increasing industrial demands, both the appropriation and the riparian rights doctrines need to be liberalized to provide increased flexibility in providing adequate water supplies to all. (Caldwell-Florida)
W70-09779

VALIDITY AND CONSTRUCTION OF ANTI-WATER POLLUTION STATUTES OR ORDINANCES.
Annot, 32 ALR3d 215-316 (1970). 102 p.

Descriptors: *Pollution abatement, *Water pollution, *Legislation, *Judicial decisions, Water pollution control, Water resources development, Legal aspects, Governments, Administration, Water law, Non-structural alternatives, Pollutants, Water quality control, Water pollution treatment, Public health, Standards, Riparian rights, Water allocation (Policy), Administrative decisions.

This annotation collects the cases in which the courts have construed or passed upon the validity of statutes or ordinances designed to control or prohibit the pollution of public waters. The annotation also includes administrative regulations or orders that are general anti-pollution measures. The subject of water pollution is within the police power of the state to protect the public health. Anti-water pollution statutes are attacked on various grounds: (1) unlawful taking or similar unreasonableness; (2) local, special or private legislation; (3) lack of authority; (4) unlawful delegation of authority, power or jurisdiction; (5) illegal promulgation; and (6) arbitrary classifications. Administrative regulations and ordinances regarding water pollution have been more prone to invalidation than have statutes. In constructing anti-water pollution measures, certain elements of specific violation have been examined by the courts: (1) the polluter, (2) the intent, (3) the pollutant, (4) the causation, (5) the pollution, and (6) the waters. Some courts have held that alleged prescriptive rights, alleged reasonable or necessary uses, and alleged financial burdens do not constitute defenses to violation of anti-water pollution measures. (Powell-Florida)
W70-09780

LIABILITY OF UNITED STATES UNDER FEDERAL TORT CLAIMS ACT FOR DAMAGE FROM FLOODING.
Annot, 4 ALR Fed 723-745 (1970). 23 p.

Descriptors: *Flooding, *Federal government, *Remedies, *Legislation, Flood damage, Floods, Flood protection, Legal aspects, Flood control, United States, Judicial decisions, Water policy, Flood forecasting, Adjudication procedure, Water rights, Projects, Federal project policy, Navigation, Irrigation, Wildlife conservation, Drainage programs.
Identifiers: *Governmental tort immunity.

In this annotation cases are collected which discuss the liability of the United States under the Federal Tort Claims Act for property damage resulting from floods or flooding. The cases annotated represent both claims allowed and barred and are

cataloged under: (1) flood control; (2) irrigation, reclamation, and conservation; (3) navigation projects; (4) flood or weather forecasting; (5) wildlife preservation and control; and (6) maintenance of drainage facilities. A claim against the government will not lie where it is determined that it arose out of certain express exclusionary clauses in the Tort Claims Act, namely, a claim arising out of a discretionary function or duty, or a claim arising out of misrepresentation. The discretionary exclusion has precluded recovery: for flood damage claims based on government flood control project activities; irrigation, reclamation and conservation project activities; and various other government programs and projects connected with waterways. The misrepresentation exception has barred flood damage claims under complaints alleging inaccurate or misleading flood or weather forecasting. A statutory immunity for flood damage is also provided in the Federal Flood Control legislation. (Powell-Florida)
W70-09781

TITLE TO SUBMERGED LAND IN FLORIDA,
Richard Sollner.
Florida State University Law Review, Vol. 1, p 1-5 (1970). 16 p.

Descriptors: *Riparian rights, *Florida, *Ownership of beds, *Boundaries (Property), Legal aspects, Tidal waters, Seashores, Navigable waters, High water mark, Beds, Beds under water, Land tenure, Foreign countries, Governments, Judicial decisions, Water law, Navigable rivers, Civil law, Public rights, Treaties, Prior appropriation, History.
Identifiers: Land grants.

In this law review article Spanish law applicable to Florida from 1783-1821 is surveyed. Spanish ordinances have been interpreted to hold that navigable waters and the land thereunder were held by the Crown for public common use, and that grants of tidal waters would be inconsistent with the King's own ordinances. However, there is justification for the conclusion that certain administrative officials were delegated the power to grant private ownership in water bottoms in connection with land grants. Under the Treaty of 1819, in which Florida was ceded to the United States, the United States agreed to confirm and ratify all grants made by the King or his lawful authorities. The treaty of cession transferred only such rights as Spain owned and could convey. The United States would not receive title to the waters and lands under the waters if Spain had validly granted them to others. American interpretation of Spanish law and land grants is reviewed. The Florida Supreme Court has indicated that, in order for a Spanish grant to convey title to submerged land, it must clearly and specifically indicate such intention and be granted for a public purpose or for the advantage of the public. (Powell-Florida)
W70-09782

MAGNOLIA APARTMENTS, INC V HANES (CLAIM OF DAMAGE CAUSED BY INCREASED FLOW FROM UPHILL PROPERTY).
174 SE2d 828-832 (NC Ct App 1970).

Descriptors: *North Carolina, *Diversion, *Saturated flow, *Seepage, Flood damage, Alteration of flow, Drainage, Drainage systems, Ditches, Drainage engineering, Damages, Pipes, Storm drains, Surface runoff, Drainage water, Subsurface flow, Natural flow, Obstruction to flow, Railroads, Legal aspects, Pondage, Flow nets, Groundwater movement.

Defendant's land lay uphill from plaintiff's property and was separated from it by a railroad. Plaintiff claimed that a landfill on defendant's property had caused excessive seepage of groundwater onto plaintiff's property, saturating the soil and causing damage. The court held that while defendant could not divert water from its natural course so as to damage another's property, he had the right to increase the flow from his property onto plaintiff's. The evidence was held insufficient to show diversion or anything more than merely increased flow. The real cause of the soil saturation was found to be seepage from an accumulation of water against the railroad embankment on defendant's side. This accumulation was itself caused by broken and stopped-up drainage pipes under plaintiff's property. These pipes normally ran from defendant's land under plaintiff's land to storm drains farther downhill. In absence of any showing that defendant's fill operations had caused the pipes to fail, the action was dismissed. (Caldwell-Florida)
W70-09783

ENVIRONMENTAL QUALITY AND THE ILLINOIS LAWYER,
For primary bibliographic entry see Field 05G.
W70-09784

SUGGESTIONS FOR A MODEL FLOOD PLAIN ZONING ORDINANCE,
For primary bibliographic entry see Field 06F.
W70-09785

OFFSHORE MINERAL RESOURCES: A CHALLENGE AND AN OPPORTUNITY.
President's Panel on Oil Spills, Offshore Mineral Resources: A challenge and an Opportunity (1969). 17 p.

Descriptors: *Resource development, *Resource allocation, *Mineralogy, *Mineral industry, Federal government, Regulation, Water resources development, Shores, Coasts, Drilling, Administrative agencies, Resources, Conservation, Economics, Research and development, State governments, Local governments, Exploitation, Oil fields, Natural gas, Legal aspects.

The President's Panel on Oil Spills examined four areas: (1) mineral resources and multiple use, (2) pollution and safety, (3) evaluation of offshore resources, and (4) central planning and local interest. The Panel recommended that: (1) a Resource Advisory Board be established to advise on all matters pertaining to the development of resources; (2) prompt efforts be made to incorporate the advice and policies of state and local governments into the plans for development of the federal offshore mineral resources; (3) well-publicized public hearings be held in the areas where offshore resource developments are contemplated; and (4) data necessary for resource evaluation held by private companies, state and local governments and any other parties to exploration and development of offshore mineral resources be made available to those who must make decisions about their exploitation. The Panel also suggested that a class of escrow resources be recognized as a matter of policy. These resources would be placed in escrow for fixed periods of time instead of being extracted at present. (Powell-Florida)
W70-09788

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.
H R Rep No 91-765, 91st Cong, 1st Sess (1969).

Descriptors: *United States, *Legislation, *Environment, *Ecology, Resource development, Legal aspects, Political aspects, Environmental effects, Federal government, Administrative agencies, Administration, Public health, Public benefits, Non-structural alternatives, Natural resources, Conservation, Land use, Supervisory control (Power), Planning, Water policy.

The purposes of the National Environmental Policy Act are: (1) to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; (2) to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; (3) to enrich the understanding of the ecological systems and natural resources important to the nation; and (4) to establish a Council on Environmental Quality. A declaration of national environmental policy is presented. The organization, duties and functions of the Council on Environmental Quality are enumerated. A statement of the House managers at the Senate House conference is set forth. (Powell-Florida)
W70-09789

ACT NO 769 (DISPOSAL FROM WATERCRAFT OF LITTER AND UNTREATED SEWAGE PROHIBITED).
Acts of Alabama, Act No 769 (1969).

Descriptors: *Alabama, *Sewage disposal, *Sewage, *Boats, Sewage treatment, Legislation, Legal aspects, Environmental sanitation, Water resources development, Regulation, Pollution abatement, Water pollution control, Waste disposal, Waste storage, Waste treatment, Marinas, Navigable waters, Permits, Regulation, Administrative agencies, Ships.
Identifiers: *Toilets.

The discharge of litter, untreated sewage from marine toilets, and other materials from a watercraft into Alabama waters is prohibited. The treatment of sewage discharged by marine toilets is required. The State Board of Health is authorized to adopt rules and regulations for the discharge of sewage and litter from watercraft, including permit requirements for manufacturers of marine toilets and devices. Marinas are required to furnish litter or trash receptacles for use by watercraft occupants. (Powell-Florida)
W70-09790

ACT NO 773 (TRANSFER OF PUBLIC WATER SYSTEMS: PROCEDURES).

Acts of Alabama, Act No 773 (1969).

Descriptors: *Alabama, *Water districts, *Water works, *Municipal water, Utilities, Regulation, Legislation, Legal aspects, Water supply, Administration.

Every public corporation which is organized in Alabama pursuant to authorization by a municipality and which owns a water system, and every municipality in Alabama in which any part of such water system is situated, is authorized to transfer and convey such systems to any other public corporation. The governing body of each transferor municipality and each transferor public corporation must authorize the conveyance of the water system through appropriate resolutions. The procedure for transfer of a water system accompanied by a lien is set forth. The form for publishing notice of a water system transfer is also prescribed. (Powell-Florida)
W70-09791

ACT NO 472 (STATE DOCKS DEPARTMENT AUTHORIZED TO CONSTRUCT AND MAINTAIN INTERNAL IMPROVEMENT FACILITIES; VARIOUS POWERS AND PURPOSES).
Acts of Alabama, Act No 472 (1969).

Descriptors: *Alabama, *Administrative agencies, *Docks, *Supervisory control (Power), Water resources development, Facilities, Engineering structures, Legis.ation, Legal aspects, State governments, Multiple-purpose projects, Right-of-way, Condemnation, Construction, Project purposes, Watercourses (Legal), Water conservation, Water utilization, Maintenance, Permits, Navigable waters, Streams.

This Alabama legislation authorizes the State Docks Department to promote and aid the commercial flow of agricultural products and the use of the waterways of the state. The Department is also

authorized to engage in works of internal improvement by promoting, developing, constructing, maintaining and operating within the state or along navigable streams and waterways all manner of facilities consistent with the 1969 Docks Amendment. The Department has the power to acquire rights-of-way and property necessary for the construction of facilities by gift, lease, purchase, negotiation, or condemnation. The Department may revoke any license granted by the state and may permit upland owners to occupy any part of the space between the high water mark and the low water mark of any navigable waterway or along the banks of any river, stream or waterway. (Powell-Florida)
W70-09792

AN ACT TO AMEND THE ALABAMA WATER MANAGEMENT ACT.
Acts of Alabama, Act No 442 (1969).

Descriptors: *Water districts, *Alabama, *Administration, *Water management (Applied), Legislation, Legal aspects, Drainage systems, Water conservation, Water utilization, Water resources development, Agricultural engineering, Civil engineering, Eminent domain, Flood protection, Flood control, Right-of-way, Taxes, Assessments, Adjudication procedure, Supervisory control (Power).

The procedure for the organization of a water management district is prescribed. Upon the filing of a petition signed by a majority of the landowners owning more than one-third of the land in a proposed district, the probate court of the county in which the lands are located appoints a civil or agricultural engineer. The duties of the engineer are enumerated. A probate court hearing is conducted for the benefit of those realty owners affected by the proposed district. The water management district, once incorporated by the probate court, is authorized to exercise the powers of eminent domain for the purpose of securing adequate outlets, floodwater retarding structure sites, and such other necessary rights-of-way. The district is authorized to perform all acts necessary and proper for the carrying out of the district's purpose. The method of allocating costs and levying taxes to defray the organizational expenses of the district is set forth. (Powell-Florida)
W70-09793

SEWAGE FACILITIES--PERMITS--INSPECTION.
Penn Gen Laws Act No 43 (1970) (amending Pub Laws 1535).

Descriptors: *Pennsylvania, *Sewage disposal, *Sewerage, *Permits, Sewage, Environmental sanitation, Sewage districts, Legislation, Legal aspects, Sanitary engineering, Sewage treatment, Pipelines, State governments, Regulation.

The Pennsylvania Sewage Facilities Act is amended to include the definition of 'individual sewage system': a single system of piping, tanks or other facilities serving one or two lots and collecting and disposing of sewage in whole or in part into the soil of the property or into any waters of this Commonwealth. 'Rural residence' is defined as a structure occupied or intended to be occupied by not more than two families on a tract of land of ten acres or more. An individual or community sewage disposal system shall not be installed without a permit indicating that the site and the plans and specifications of such system are in compliance with the provisions of the Pennsylvania Sewage Facilities Act. Enumerated municipal and county departments are exempted from the permit requirement. (Powell-Florida)
W70-09794

ACT NO 479 (LEASE OF STATE HELD MINERAL, OIL AND GAS RIGHTS UNDER WATER).
Acts of Alabama, Act No 479 (1969)

Descriptors: *Leases, *Alabama, *Natural resources, *Beds under water, Conservation, Water resources development, Legislation, Legal aspects, Regulation, Exploitation, Oil fields, Mining, Navigable waters, Streams, Bays, Bayous, Lakes, Lake beds, Gulf of Mexico, Lagoons, Estuaries, Mineralogy, Oil, Natural gas.

Under the provisions of this Act, all lands proposed to be leased for oil, gas or mineral exploitation shall be leased only upon the basis of competitive bids. The procedure for the competitive bidding, as conducted by the Director of Conservation, is set forth. All revenue accruing from the lease of the bed of any navigable streams, waterways, bays, estuaries, lagoons, bayous, lakes, and any submerged lands in the Gulf of Mexico within the seaward boundary of Alabama shall become a part of the state's general funds. (Powell-Florida)
W70-09795

RIGGS V CITY OF SPRINGFIELD (ACTION TO ABATE TEMPORARY NUISANCE NOT BARRED BY STATUTE OF LIMITATIONS).
96 SW2d 392-400 (Mo Ct App 1936).

Descriptors: *Missouri, *Water pollution, *Sewage, *Remedies, Cities, Municipal wastes, Judicial decisions, Legal aspects, Local governments, Reasonable use, Waste disposal, Sewage treatment, Sewage disposal, Riparian rights, Pollution abatement, Damages, Adjudication procedure, Legislation, Streams.
Identifiers: Nuisance (Temporary), Nuisance (Permanent).

In 1893, defendant city erected a general sewer system whereby the untreated sewage from the city was discharged into a nearby creek. In 1913 and 1928, defendant city installed, remodeled and improved sewage plants. Plaintiff landowners brought an action for damages caused by the alleged failure of the defendant city to properly purify sewage emptying into the creek. The creek ran through the property of plaintiff landowners. Plaintiffs' case theory was that the city had established a temporary nuisance about one year after the completion of the 1928 plant. Defendant contended that the general sewer system had been maintained since 1893, thus giving defendant a prescriptive right to use the creek and barring plaintiffs' action because of the statute of limitations thereon. The Springfield Court of Appeals affirmed the trial court's decision for plaintiffs and held that the complaint was not barred where the nuisance was temporary or abatable and not permanent. The dissenting opinion argued that a permanent injury was created in 1893 and plaintiffs would have been entitled to consequential damages only had they instituted a suit within the statutory period. (Powell-Florida)
W70-09825

AMERICAN RED CROSS V HINSON (ELEMENTS REQUIRED TO ESTABLISH NAVIGABILITY FOR FEDERAL LAW PURPOSES).

122 SW2d 433-435 (Tenn 1938).

Descriptors: *Tennessee, *Jurisdiction, *Navigable rivers, *Overflow, Non-navigable waters, Judicial decisions, Legal aspects, Levees, Flooding, Floods, Navigable waters, Mississippi River, Admiralty, Federal government, Federal jurisdiction, Legislation, State jurisdiction, Water courses (Legal).

Plaintiff widow sued defendant under the Tennessee Workmen's Compensation Law for the accidental death of her husband arising out of and in the course of his employment. The place of the accident was within a levee on the Arkansas side of the Mississippi River, but some distance from the river bank. The area was usually dry land and was covered with water only during flooding. Defendant contended the accident occurred on navigable water and that any recovery by plaintiff must be had under the Federal Longshoreman and Harbor Workers' Compensation Act or the Jones Act. The court agreed with the trial judge that the accident took place on overflowed lands, not navigable waters, and that plaintiff was entitled to recover under state law. To constitute a navigable stream the seasons of navigability must occur regularly and be of sufficient duration to serve a useful public purpose for commercial intercourse. The judgment for plaintiff was affirmed. (Price-Florida)
W70-09834

WATER-SUPPLY STRINGENCIES-FEATURES, ANTECEDENTS AND OBSTACLES TO RESOLUTION,
Geological Survey, Carmel, Calif.
For primary bibliographic entry see Field 06B.
W70-09852

RAULS V COSTNER (DRAINAGE DISTRICT'S LIABILITY FOR FLOOD WATERS CAUSED BY ERECTION OF NEW LEVEE).

143 SW2d 1090-1094 (Ark 1940).

Descriptors: *Arkansas, *Levees, *Drainage districts, *Flood damage, Dams, Surface drainage, Water injury, Flooding, Compensation, Remedies, Flood control, Judicial decisions, Adjudication procedure, Legal aspects, Water law, Riparian water, Riparian land, Natural flow doctrine, Streamflow, Rivers, Navigable rivers, Surface water, Lakes, Streams, Impounded waters.
Identifiers: *Servitudes.

Plaintiff landowner brought an action against defendant drainage district for damages to plaintiff's land caused by the construction of a new levee. The levee raised the water level adjacent to plaintiff's land, subjecting it to increased flooding at times of high water. Plaintiff contended that his property was protected from flood waters by the old levee but not by the new levee. Defendant argued that there was insufficient evidence to support plaintiff's contentions and that there could be no liability for leaving riparian land exposed to floods, a natural servitude of such land. Reversing a judgment for plaintiff, the court held that a riparian owner takes his land subject to possible flood damage, and a drainage district is not liable for such damage unless it can be shown that the levee has caused the flood waters to be permanently impounded on plaintiff's land. (Liptak-Florida)
W70-09895

A DYNAMIC MODEL OF WATER QUALITY MANAGEMENT DECISION-MAKING' SYSTEMATIC ANALYSIS OF THE MANAGEMENT EFFECTIVENESS OF THE WATER QUALITY CONTROL BOARD SYSTEM OF CALIFORNIA,
Engineering-Science, Inc., Oakland, Calif. Research and Development Lab.
For primary bibliographic entry see Field 06A.
W70-09908

STRECKFUS STEAMERS, INC V KEITEL (MISSISSIPPI RIVER EMPLOYEES NOT EXEMPT FROM UNEMPLOYMENT TAX AS AN EXCISE ON THE USE OF THE RIVER).

182 SW2d 587-589 (Mo 1944).

Descriptors: *Mississippi River, *Navigation, *Taxes, *Employment, Missouri, Navigable rivers, Tariff, Boats, Unemployment, Compensation, Insurance, Welfare (Economics), Occupations, Personnel, Administrative agencies, Administrative decisions, Interstate rivers, Transportation, Highways, Ships, Cruises, Judicial decisions, Legal aspects, State governments, Legislation.

Plaintiff steamboat operator sought judicial review of a decision by defendant unemployment compensation commissioner to the effect that plaintiff's employees were subject to state unemployment compensation tax. Plaintiff contended that since both the Missouri constitution and federal law provide that the Mississippi River is a public highway

d that use of the river should be free to all thout any tax, duty, or toll, his employees who erated boats on the river were exempt from the x. Defendant contended that the tax was on em-oyment, not navigation of the river, and hence s not a toll for use of the river but a general tax posed on all citizens engaged in any kind of em-oyment. Reversing a lower court judgment for aintiff, the Supreme Court of Missouri held that e fact that plaintiff's employees happened to ork on the river did not convert the unemploy-ent tax into a tax upon the use of the river, nor d it exempt them from the imposition of the tax. iptak-Florida)
70-09912

ENTUCKY GAME AND FISH COMM'N v IRNETT (STATE FISH COMMISSION'S LIA-LITY FOR FLOOD DAMAGE CAUSED BY RECTION OF DAM FOR FISH HATCHERY).
0 Ky 786, 163 SW2d 50-53 (1942).

escriptors: *Kentucky, *Dams, *Flood damage, ish hatcheries, State governments, Administra-e agencies, Backwater, Water injury, Compensa-n, Condemnation, Condemnation value, minent domain, Streams, Judicial decisions, Legal pects, Adjudication procedure, Water law, blic rights, Property values, Land appraisal, oding, Damages, Access routes.

aintiff landowner brought an action against de-ndant state game and fish commission for mages resulting from defendant's construction of lam and a fish hatchery. The construction caused rtial flooding of plaintiff's land and the destruc-n of a creek ford which was plaintiff's means of gress and egress. Plaintiff argued that he was enti-d to damages and an injunction restraining de-ndant from maintaining the dam. Defendant con-ted the proof of damages. Affirming a judgment r plaintiff on the damages and for defendant on e injunction, the Court of Appeals of Kentucky ld that conflicting proof of damages was properly bmitted to the jury. As to the injunction, the urt pointed out that the damage award was tan-mount to a condemnation and, upon satisfaction the judgment, defendant would be vested with e right to maintain the dam in its present condi-n. (Liptak-Florida)
70-09913

UST V CITY OF NEWPORT (CITY'S LIABILI-Y FOR WATER DAMAGE TO PROPERTY LONG NEW ROAD CONSTRUCTION).
4 Ky 567, 145 SW2d 511-512 (1940).

escriptors: *Kentucky, *Road construction, *Set-ment (Structural), *Surface runoff, Diversion, ainage water, Cities, Local governments, Adju-cation procedure, Judicial decisions, Legal pects, Damages, Roads, Paving, Washouts, Sub-lence, Flood damage, Water injury, Surface ainage, Adjudication procedure.

aintiff landowner brought an action against de-ndant city to recover damages to plaintiff's use. The damage was allegedly caused by diver-n of water onto plaintiff's property by defen-nt's street construction. Plaintiff contended that e street was so negligently constructed as to use water to collect on his property, resulting in ttlement and cracking of his floor and walls. De-ndant denied the negligence and offered proof of her causes of plaintiff's damage. Affirming a dgment for defendant, the court held it would not erturn the jury's verdict when there was suffi-ent evidence to support it, especially when the y had viewed the premises. (Liptak-Florida)
70-09931

YLE V ST FRANCIS LEVEE DIST (LEVEE STRICT'S LIABILITY FOR WATER AMAGE CAUSED BY INTERFERENCE WITH URFACE DRAINAGE).
3 SW2d 391-393 (Mo Ct App 1941).

Descriptors: *Missouri, *Repulsion (Legal aspects), *Levees, *Surface runoff, Water injury, Damages, Judicial decisions, Legal aspects, Dikes, Flood control, River regulation, Underseepage, Mississippi River, Surface waters, Drainage water, Rain water, Surface drainage, Standing waters, Cultivated lands, Arable land, Federal government, Administrative agencies, Land tenure, Saturated soils.
Identifiers: *Levee districts.

Plaintiff landowner brought an action against defendant levee district to recover damages for water injury to his property. The damage was allegedly caused by the erection of a new levee which interfered with the natural surface drainage of plaintiff's property. Plaintiff contended that his property had been useful for farming since the construction of the old levee, but that the new levee had interfered with his natural drainage, making his fields soggy and swampy. Defendant denied the injury to the property and argued that the federal government had built the new levee and should be liable for damage caused thereby. Reversing a judgment for plaintiff, the court noted that plaintiff's land was obviously damaged, but held that since defendant had not built and did not own the levee, but merely maintained it, defendant could not be liable for injuries caused by the construction. (Liptak-Florida)
W70-09940

STEWART V CITY OF SPRINGFIELD (CONSTRUCTIVE CONDEMNATION OF A STREAM BY POLLUTION).

165 SW2d 626-631 (Mo 1942).

Descriptors: *Missouri, *Condemnation, *Local governments, *Water pollution, Appropriation, Community development, Eminent domain, Human population, Judicial decisions, Legal aspects, Proprietary power, Public rights, Relative rights, Riparian land, Riparian rights, Riparian waters, Sewage districts, Watercourses (Legal), Pollution abatement, Damages, Sewage, Remedies.
Identifiers: *Nuisance (Legal).

Defendant city built sewers which emptied into and polluted a stream which flowed through plaintiffs' lands. In three separate suits, plaintiffs brought actions against defendant for creating an abatable temporary nuisance. Plaintiffs received judgments in each case. Defendant reserved the right to raise any defenses it might have in future suits. In a fourth suit defendant claimed that it had long since appropriated the use of the creek under its right of eminent domain and that the statute of limitations had run against all of plaintiffs' claims. Plaintiffs asserted that defendant was estopped to use this defense. The court held that since previous judgments could not estop plaintiffs from future claims of permanent damages, they did not estop the city from asserting its permanent appropriation. The court further held that a municapality could, and in this case did, appropriate a stream for sewer purposes without instituting proceedings to condemn it by eminent domain. Normally, riparian owners would be entitled to full compensation for damages to their land caused thereby. In the case, however, the statutory period for filing for such damages had run. (Clarke-Florida)
W70-09979

MADDOX V INTERNATIONAL PAPER CO (PAPER MILL'S LIABILITY FOR FISHKILL CAUSED BY WATER POLLUTION).

47 F Supp 829-832 (WD La 1942).

Descriptors: *Louisiana, *Water pollution, *Pulp wastes, *Fishkill, Commercial fishing, Acid streams, Pollution abatement, Riparian rights, Pollutants, Water pollution effects, Remedies, Legal aspects, Water law, Adjudication procedure, Judicial decisions, Legislation, Riparian waters, Industrial wastes, Pulp and paper industry, Pulp wastes.

Plaintiff fishing camp operator sought damages and an injunction because of defendant paper company's operations which polluted the water, killing the fish and destroying plaintiff's fishing business. Plaintiff contended that defendant paper company, being an upstream owner, was liable for any damage suffered by downstream owners caused by the discharge of acids and other pollutants from defendant's settling basins. Defendant argued that plaintiff could not recover for the death of the fish because fish are property of the state and not subject to private ownership. The court held that, since under the Louisiana Code every act which causes damage to another is the proper subject of reparation, plaintiff was entitled to recover for lost profits. However, with an adequate remedy at law, plaintiff was not entitled to an injunction. The court also noted that defendant's efforts to prevent the pollution would protect it from punishment, but were no defense to an action for damages. (Liptak-Florida)
W70-09980

HAMPTON V NORTH CAROLINA PULP CO (ACTION TO RECOVER FOR FISHKILL CAUSED BY PULP WASTES).
49 F Supp 625-632 (ED NC 1943).

Descriptors: *North Carolina, *Fishkill, *Commercial fishing, *Water pollution effects, Commercial fish, Stream fisheries, Fishing, Spawning, Fish reproduction, Fish migration, Riparian rights, Usufructuary right, Water pollution, Wastes, Pollutants, Water pollution sources, Damages, Judicial decisions, Legal aspects, Remedies.

Plaintiff riparian landowner brought an action against defendant company to recover for lost revenue caused by defendant's destruction of fish. Defendant's pulp plant discharged certain amounts of waste products into the river, and plaintiff claimed his fisheries were deprived of their expected catch. The United States District Court for the Eastern District of North Carolina ruled that plaintiff had no interest in the fish before reduction to acual possession, but had only a right to fish in the river in common with the public. The case was dismissed. (Barker-Florida)
W70-09981

UNITED STATES V FLORIDA POWER AND LIGHT CO (INJUNCTION AGAINST THERMAL POLLUTION).
311 F Supp 1391-1392 (SD Fla 1970).

Descriptors: *United States, *Florida, *Thermal pollution, *Electric powerplants, Facilities, Water pollution, Heated water, Pollutants, Pollution abatement, Temperature, Governments, Legislation, Remedies, Aquatic life, Damages, Judicial decisions, Legal aspects, Adjudication procedure.
Identifiers: *Biscayne Bay.

The United States sought a temporary injunction against defendant power company to prevent further discharge of heated water into Biscayne Bay, Florida. Plaintiff contended that such thermal pollution was dangerous to the marine life of the bay. The United States District Court for the Southern District of Florida held that even though injunctive relief in such a case was proper under the Rivers and Harbors Act, the injunction would not be issued in the absence of a showing of irreparable harm. Such irreparable damage not having been proved, the injunction was not granted. (Barker-Florida)
W70-09982

INTERNATIONAL SHOE CO V HEATWOLE (PRIVATE CAUSE OF ACTION FOR POLLUTION).

30 SE 2d 537-541 (W Va 1944).

Descriptors: *West Virginia, *Water pollution, *Riparian rights, *Riparian waters, Judicial deci-

sions, Legal aspects, Impaired water quality, Nonconsumptive use, Pollution abatement, Streams, Pollutants, Reasonable use, Wastes, Water pollution effects, Industrial wastes, Chemical wastes, Industrial plants, Industrial production, Competing uses, Industrial water, Aesthetics, Jurisdiction, Recreation, Relative rights, Remedies.

Plaintiff landowner, in an action brought before a justice of the peace, sought compensation for damages allegedly caused by defendant industry's discharge of waste into a river abutting plaintiff's property. Damages alleged included discoloration of the water, interference with fishing in the river, and a decrease in value of plaintiff's property. The justice held for plaintiff. Defendants sought a writ of prohibition in the Supreme Court of Appeals of West Virginia to forbid the enforcement of the judgment. Defendants contended that pollution of a stream is a public wrong creating no cause of action enforceable by a riparian owner and that no private damage was done plaintiff. The court held that pollution of a river is a public wrong and, to recover damages, a riparian owner must show damage of a different character than that of the public at large. A riparian owner has not proprietary right in a river's beauty, nor does he have an exclusive right to fish or bathe. Plaintiff would have had a right of action if sediment from defendant's plant had been deposited on his land. However, since plaintiff nowhere alleged that his use of his land was interfered with, the judgment in his favor was improper. A writ of prohibition was issued forbidding enforcement of the judgment. (Dye-Florida)
W70-09983

UNITED STATES V 25.4 ACRES OF LAND (OWNERSHIP OF RIPARIAN LAND CREATED BY LANDFILL--CONDEMNATION PROCEEDINGS).
52 F Supp 75-89 (ED NY 1943).

Descriptors: *United States, *New York, *Land tenure, *Condemnation, Cities, Riparian land, Land, Real property, Eminent domain, Governments, Compensation, Bulkheads, Landfills, High water mark, Low water mark, Ownership of beds, Boundaries (Property), State governments, Judicial decisions, Legal aspects, Boundary disputes.

In a condemnation proceeding, the State of New York and the City of New York objected to the payment of certain awards to the alleged owners of the condemned property. Both governments challenged the titles of the owners and claimed that title had remained vested in the respective governments. A portion of the land in question had originally been underwater, but had been bulkheaded and filled by the predecessors in title of the alleged current owners. The United States District Court, Eastern District of New York, ruled that an examination of both the grants and subsequent possesstion of the land in question showed good title to be in the alleged owners, not in either of the governments. The full condemnation awards were given the owners. (Barker-Florida)
W70-09984

CHICK SPRINGS WATER CO V STATE HIGHWAY DEPT (STATE'S LIABILITY FOR FLOOD DAMAGE CAUSED BY NEGLIGENT CULVERT CONSTRUCTION).
183 SE 27-33 (SC 1935).

Descriptors: *South Carolina, *Flood damage, *Culverts, *Compensation, Highways, Rainfall, Cloudbursts, Legal aspects, State governments, Condemnation, Eminent domain, Judicial decisions, Adjudication procedure, Drains, Drainage effects, Flooding, Floods, Administrative agencies, Storm runoff, Water injury, Highway effects, Highway relocation, Road construction, Roadbanks, Remedies.

Plaintiff water company brought an action for damages against defendant state highway department for flood damage caused by the inability of a culvert, built by defendant, to carry off rain water. Plaintiff contended that the culvert was negligently constructed in the first place, and after one flooding, plaintiff had warned defendant that further flooding was imminent. Plaintiff argued that the failure to enlarge the culvert was a taking of property for public use. Defendant contended that the matter was res judicata since plaintiff had already brought an action for the negligent construction of the culvert which action resulted in a verdict for defendant on the ground that the rainstorm was an unprecedented act of God. Reversing an order sustaining defendant's demmurer, the court held that there is no identity of causes of action when one action is brought for the creation of a nuisance and another is brought for the maintenance of a nuisance. The court reasoned that even if the first rainstorm was unprecedented in defendant's experience, plaintiff's subsequent warnings put defendant on notice and under a duty to maintain the culvert so as to prevent further damage to plaintiff's land. One justice dissented. (Liptak-Florida)
W70-09985

IN RE CAVANAUGH (CITY'S LIABILITY UNDER EMINENT DOMAIN FOR SUBSIDENCE DAMAGE CAUSED BY SEWER CONSTRUCTION).
183 A 360-363 (Pa Super Ct 1936).

Descriptors: *Pennsylvania, *Sewers, *Land subsidence, *Trenches, Condemnation, Eminent domain, Compensation, Adjudication procedure, Judicial decisions, Legal aspects, Cities, Local governments, Excavation, Damages, Settlement (Structural), Storm runoff, Washouts, Remedies, Drainage effects, Cloudbursts, Excessive precipitation.
Identifiers: Causation (Legal).

Plaintiff landowners sought damages for injury to their property caused by defendant city's sewer construction. Defendant had dug a trench adjoining plaintiffs' property and a rainstorm had filled the trench with water. This undermined plaintiffs' property, causing it to subside. Plaintiffs contended that the damage was a direct and unavoidable result of defendant's construction of the sewer. Defendant contended that the damage proceedings were improper because the rainstorm was an act of God and that, as a matter of law, defendant should not be liable unless negligence was shown. Affirming the dismissal of defendant's appeal, the court held that although the question of the propriety of the proceedings was for the court, the question of proximate cause was properly for the jury's determination. Thus, it was proper for the trial court, in reviewing the referee's findings, to determine whether the damage was the necessary result of digging the trench or an act of God. (Liptak-Florida)
W70-09986

PARKS V BENNING (LEASE OF OYSTER BEDS).

188 A 787-790 (Md 1937).

Descriptors: *Maryland, *Oysters, *Leases, *Beds under water, Beds, Ownership of beds, River beds, Governments, Legislation, Relative rights, Land tenure, Riparian land, Rent, Remedies, Judicial decisions, Legal aspects, Water law, Local governments, Third party effects, Shellfish, Commercial shellfish.

Plaintiff riparian landowner sought an injunction against defendant's lease of an oyster bed. A Maryland statute provided for such leases, but only to bona fide residents of the state. Plaintiff claimed that defendant was merely a 'straw man' and that another party, not a resident, was to be the beneficiary of the lease. Defendant argued that his part-time employment by the third party had no relation to the lease of the bed and the fact that the third party, on whose land the beds fronted, had paid the first year's rent was merely coincident with their acquaintance. The trial court enjoin the lease but the Court of Appeals of Maryla reversed, saying that the friendship between t nonresident riparian landowner and the lessee of oyster bed in front of his land did not violate t law which preserved such leases to residents on (Barker-Florida)
W70-09987

STAMFORD DOCK AND REALTY CORP CITY OF STAMFORD (CITY'S LIABILITY FO SEDIMENT DISCHARGE FROM STOR DRAINS AND SEWERS).
124 Conn 341, 200 A 343-346 (1938).

Descriptors: *Connecticut, *Sewers, *Navigatio *Sediment discharge, Local governments, Stor runoff, Drains, Drainage effects, Silts, Sediment Water pollution, Navigable water, Transportatio Cities, Legal aspects, Adjudication procedure, J dicial decisions, Public rights, Municipal waste Canals, River basins, Damages, Compensatio Silting, Remedies.
Identifiers: Governmental immunity.

Plaintiff shipping company sought to enjoin defer dant city from maintaining its storm drains an sewers so as to allow silt and other refuse t discharge into the navigable basin where plainti carried on its business, thereby causing the basin t fill up with sediment and be unfit for navigatio Plaintiff contended that the obstruction of th basin was a public and private nuisance which de fendant should be required to correct. Defendan argued that the maintenance of the storm drain and sewers was a governmental function, that it wa immune to liability for negligence, and that the sil and other refuse were results of acts of God. Af firming a judgment for defendant, the court hel that it could not be said as a matter of law that th damage to plaintiff's property and business was no caused by an act of God. Moreover, governmenta immunity was a good defense against a claim o negligence whether or not the negligence resulte in a nuisance. (Liptak-Florida)
W70-09988

COMMONWEALTH EX REL BARD V DELAWARE DIVISION CANAL CO (RESTRIC TIONS ON CANAL COMPANY'S USE OF PRO PERTY ARE NOT CONDITIONS OF TITLE).

332 Pa 53, 1 A2d 672-677 (1938).

Descriptors: *Pennsylvania, *Canals, *Land tenure, *Navigation, Competing uses, Industrial use (Water), Legislation, State governments, Adjudication procedure, Judicial decisions, Legal aspects, Water law, Water rights, Public rights, Transportation, Real property, Water quality, Highways, Navigable waters, Reasonable use, Consumptive use.

Plaintiff state of Pennsylvania sued defendant canal company for a decree of forfeiture revesting in the state title to land previously conveyed to defendant for use as a canal. Plaintiff contended that the terms of the conveyance limited use of the land to canal purposes and imposed a condition upon the title which should cause a forfeiture. Defendant had discontinued using the property for canal purposes. Plaintiff argued alternatively that the restrictive terms of the deed should be taken as covenants, and defendant should be required to restore the canal to navigable capacity. Defendant contended that mere declarations of purpose do not impose conditions upon title and that later legislation specifically authorized canal companies to use their water supply for other commercial purposes. Affirming a decree in favor of defendant, the court held that attempted restrictions on titles are strictly construed in favor of free alienation and that conditions on titles must be clearly stated. The court further noted that the terms of the deed referred to defendant's status as a common carrier, and defendant was no longer engaged in that business. In

ght of specific enabling legislation, defendant was ithin its rights to make other uses of its water upply so long as defendant did not pollute the aters or otherwise maintain the water supply so as create a nuisance. (Liptak-Florida)
/70-09989

ILGRIM PLYWOOD CORP V MELENDY (LIA-ILITY FOR OBSTRUCTION OF ACCESS OAD CAUSED BY DAM BACKWATER).
A2d 700-703 (Vt 1938).

escriptors: *Vermont, *Access routes, *Dams, Backwater, Lumbering, Roads, Condemnation, ublic utilities, Adjudication procedure, Judicial ecisions, Legal aspects, Public rights, Water law, emedies, Flood damage, Local governments, nited States, Cities, Eminent domain, Real pro-erty, Hydroelectric plants, Streams, Highway relo-ation, Damsites.
entifiers: Injunction.

aintiff lumber company sued defendant board of ublic works to enjoin the closing of a dam which ould cause flooding of the only road leading to aintiff's timber land. Plaintiff contended that no roceedings had been instituted to acquire the right flood the public highway, that the only land itable for an alternate access route to plaintiff's roperty had been acquired by defendant under the ate's eminent domain powers, and that defendant ad represented that an alternate access route ould be provided. Defendant contended that aintiff failed to establish that the flooding was an egal act as to plaintiff and that there was an lequate remedy at law since plaintiff could peti-on the town to provide an access road to the pro-erty. Reversing a decree in defendant's favor, the ourt noted that the obstruction or destruction of a ublic road could be enjoined as a nuisance if aintiff could show some special injury and held at cutting off plaintiff's only means of ingress and ress from his property was such a special injury. he court also noted that the remedy at law was in-lequate since plaintiff would be required to pay a bstantial portion of the cost of a road obtained by tition. However, the court held that injunctive lief should be delayed to give defendant reasona-e opportunity to acquire, if possible, the right to od the road. (Liptak-Florida)
70-09990

ORTON V BOROUGH OF DORMONT (CI-Y'S LIABILITY FOR DAMAGE CAUSED BY CREASE IN NATURAL FLOW OF SURFACE ATER).

A2d 803-804 (Pa 1939).

escriptors: *Pennsylvania, *Sewers, *Drainage ater, *Riddance (Legal aspects), Eminent main, Damages, Remedies, Compensation, ocal governments, Cities, Legal aspects, Judicial cisions, Water law, Adjudication procedure, Sur-ce waters, Surface runoff, Flood damage, Water jury, Surface drainage, Storm drains, Natural reams, Artificial watercourses, Drainage effects.

aintiff property owner brought an action for mages against defendant city. The claim arose om water damage to plaintiff's farm caused by de-ndant's construction of storm sewers which in-eased the natural flow of surface water across aintiff's land. Plaintiff contended that a city ould be liable for artificial improvements which llect surface water and discharge it onto servient nd with such force as to cause flood damage. De-ndant contended that there was no compensable jury to plaintiff since the sewers were constructed rsuant to the city's lawful authority. On plain-f's appeal from a nonsuit, the court noted that a y could not be held liable for improvements hich merely increased the flow of surface water in natural watercourse. However, the city would be ble if the increased flow were discharged at some int on the servient land where the water would t have been naturally discharged. Therefore, the court reversed the judgment of nonsuit and remanded the case to determine whether the damage to palintiff's land fell within the rule of liability. (Liptak-Florida)
W70-09991

GRAF V CITY OF NEWARK (CANAL COMPANY'S AUTHORITY NOT LIMITED TO NAVIGATION WHEN CONSIDERING CONDITIONAL TITLE).
124 NJL 312, 11 A2d 764-766 (1940).

Descriptors: *New Jersey, *Canals, *Land use, *Land tenure, Cities, Legislation, Judicial decisions, Real property, Highways, Transportation, Navigation, Condemnation, Eminent domain, Compensation, Local governments, Legal aspects, State governments, Public rights.

Plaintiff's ancestor conveyed land to a canal company. The land was to be used pursuant to the canal company's statutory authority. Defendant city acquired the property after the canal company had abandoned the canal, and the city used the property for a public road. Plaintiff sued defendant for damages for taking of the property and contended that the land should have reverted when it was no longer used for navigation. Although the canal company's charter limited its powers to canal purposes, the court held that the canal was a public highway and its use was not limited to transportation by water. The court also noted that legislation authorizing cities to acquire the canal property was tantamount to an amendment of the company's charter, and the state's abandonment of the canal did not presume a relinquishment of the state's rights in the property. (Liptak-Florida)
W70-09992

WEBBER V POLICE JURY (TITLE TO LAND IN ABANDONED DRAINAGE DISTRICT).
48 F Supp 350-357 (WD La 1943).

Descriptors: *Louisiana, *Drainage districts, *Land tenure, *Canals, Real property, Land, Land use, Administrative agencies, Levees, Drainage, Governments, Public lands, Public rights, Ditches, Administrative decisions, Flood control, Economics, Local governments, Remedies, Judicial decisions, Legal aspects.

Plaintiffs, owners of lands encompassed by a previously abandoned drainage sub-district, sought to have title to a canal and levee on one boundary of the property declared to be in them. Plaintiffs claimed that the title had been transferred by the board of commissioners of the parent drainage district when the smaller project was abandoned. Defendant police jury argued that no such transfer was made and that the original grants of the land in question reserved such land for public use. The United States District Court for the Western District of Louisiana ruled that the parent drainage district had expressly not conveyed the entire canal or the levee to palintiffs and that defendants acted properly in treating the land as publicly owned. Plaintiffs' suit was dismissed. (Barker-Florida)
W70-09993

UNITED STATES V CERTAIN LANDS IN TOWN OF HIGHLANDS (FEDERAL GOVERNMENT'S CONDEMNATION OF LAND CONSTITUTING A LOCAL WATERSHED).
48 F Supp 306-308 (SD NY 1942).

Descriptors: *Condemnation, *Watersheds (Divides), *Federal government, *Water supply, Watershed management, New York, Eminent domain, United States, Governments, Water law, Legal aspects, Legislation, Water rights, Cities, Judicial decisions, Land use, Local governments, Public utilities.

The United States sought to condemn and acquire certain land to be used for expansion of the West Point military reservation. The expansion was pursuant to an act of Congress which provided that nothing in the act should be taken to adversely affect the water supply of a nearby town. The town's only water company intervened in the condemnation proceedings and contended that, although it owned none of the property to be condemned, the property was a large part of the watershed and supplied a large part of the company's and the town's water supply. The company argued that the act's proviso prohibited a taking of such land. The Secretary of War expressly disclaimed any intent to acquire any of the company's rights, title, or interest in any of the land. The court held that the Secretary's disclaimer gave the water company all the protection it needed. The court reasoned that Congress intended to protect the town's water supply and that it could be be assumed that the Army's presence would adversely affect the watershed any more so than that of the present owners. (Liptak-Florida)
W70-09994

GULF OIL CORP V THE BALTIMORE (DREDGE COMPANY'S LIABILITY FOR OBSTRUCTION OF NAVIGABLE CHANNEL).
47 F Supp 770-773 (ED NY 1942).

Descriptors: *New York State Barge Canal, *Navigation, *Channel improvement, *Boulders, New York, Adjudication procedure, Excavation, Channels, Open channels, Navigable waters, Admiralty, Ships, Dredging, Legal aspects, Judicial decisions, Water law.

Plaintiff oil company sued defendant dredge company in admiralty for damages to plaintiff's ship. The ship had collided with a rock left by defendant's dredging operations in the New York State Barge Canal. Plaintiff contended that defendant had a duty, under its contract with the state, to sweep the channel after dredging operations to locate and correct any obstructions to navigation. Defendant contended that the rock might have fallen from the bank and not been dislodged by defendant's dredging operation. Defendant argued further that plaintiff was negligent in not navigating the center of the old channel. The court held that, once plaintiff had shown sufficient facts to make out a case, the burden was on defendant to explain the obstruction in an area which defendant had a duty to keep open for navigation. The court also noted that plaintiff's failure to use the center of the old channel was not negligence since the purpose of dredging and widening the canal was to make it safe for passage at points other than the old center. (Liptak-Florida)
W70-09995

GALLERANI V UNITED STATES (DAMAGE TO WELL FROM CANAL IMPROVEMENT).
41 F Supp 293-294 (D Mass 1941).

Descriptors: *United States, *Massachusetts, *Damages, *Percolating water, Subsurface water, Wells, Canals, Navigation, Legislation, Land tenure, Remedies, Judicial decisions, Legal aspects, Governments, Drawdown, Eminent domain, Compensation, Relative rights.
Identifiers: *Cape Cod Canal.

Plaintiff landowner brought suit against the United States for an alleged 'taking' of his property. The United States had appropriated land adjacent to plaintiff's property for the purpose of improving the Cape Code Canal, and subsequent to the improvement operations, a well on plaintiff's land dried up. The United States District Court for Massachusetts ruled that the taking of the adjacent land was a proper purpose, that there was no property right in the underground percolating waters, and that any injury resulting from the loss of such water through the lawful acts of an adjoining landowner must be considered damnum absque injuria. The United States' motion to dismiss was granted. (Barker-Florida)
W70-09996

OAKLAND CLUB V SOUTH CAROLINA PUBLIC SERVICE AUTH (SUIT TO ENJOIN CONDEMNATION OF PROPERTY FOR A DAMSITE).

30 F Supp 334-341 (ED SC 1939).

Descriptors: *South Carolina, *Condemnation, *Legislation, *Damsites, Remedies, Dams, Hydroelectric plants, Payment, Costs, Federal Power Act, Administrative agencies, Eminent domain, Land tenure, Legal aspects, Project purposes, Reservoirs, Judicial decisions, Damages, Permits, Federal project policy, Compensation, Reservoirs, Reservoir construction, Adjudication procedure.
Identifiers: *Constitutionality, Injunction.

Plaintiff sought to enjoin the defendant public service authority from condemning plaintiff's land for a damsite. As the defendant was acting under authority of both a state statute and the Federal Power Act, plaintiff claimed that the Federal statute pre-empted defendant's condemnation powers under state law. Both this claim and defendant's argument that the state statute was unconstitutional, in not setting up a proper method of payment, were rejected by the court. The court upheld the state law, which provided for compensation to be initially fixed by a panel of referees with the condemnee having a right of a de novo jury trial if he were dissatisfied with the award. The plaintiff also argued that the federal statute only provided for condemnation of 'damsites', which could not include land to be covered by the reservoir backed up by the dam. The court rejected this argument also, holding that the common usage of the term 'damsite' included the resulting reservoir. (Caldwell-Florida)
W70-09997

UNITED STATES EX REL TVA V VOGLE (UNITED STATES' CONDEMNATION OF MINERALS FOR TVA PURPOSES).

28 F Supp 454-455 (WD Ky 1939).

Descriptors: *Tennessee Valley Authority Project, *Condemnation, *Damsites, *Eminent domain, Land use, Federal government, Federal project policy, Legal aspects, Judicial decisions, Mining, Quarries, Dams, Dam construction, Concrete dams, Reservoirs, United States, Legislation, Adjudication procedure, Limestones, Public rights, Public utilities, Land tenure, Compensation.

The United States petitioned to condemn respondent's property for use by the Tennessee Valley Authority. Respondent contested the authority to condemn that part of his property which would not be flooded by the proposed reservoir but would be used to mine limestone rock for construction of the dam. Respondent contended that property not needed directly for the dam was not necessary and could not be condemned. The court held that it could pass only on what constituted a public taking and that the question of the necessity of a particular taking was for the legislature. Therefore, the court was without power to review the government's decision that this property was necessary for the purposes of the Tennessee Valley Authority. (Liptak-Florida)
W70-09998

UNITED STATES V 80 ACRES OF LAND (AUTHORITY FOR CONDEMNATION).
26 F Supp 315-322 (ED Ill 1939).

Descriptors: *United States, *Eminent domain, *Multiple-purpose projects, *Condemnation, Legislation, Governments, Soil converation, Water conservation, Erosion control, Forest management, Project purposes, Forestry, Water pollution control, Flood control, Federal project policy, Public benefits, Administration, Administrative agencies, Economic impact, Compensation, Remedies, Judicial decisions, Legal aspects, Social aspects.
Identifiers: *Constitutionality

In a condemnation proceeding the United States sought to acquire defendants' land which lay within the area to be affected by a project under the National Industrial Recovery Act. Defendants moved to dismiss on the grounds that the statutes were unconstitutional and that the proposed project was not properly within the definition of the public purpose doctrine. The United States District Court, Eastern District of Illinois, found that the project was designed for the purposes of conservation, pollution control, forestation, flood control, and unemployment relief, and was therefore clearly within the scope of public purpose. The court further ruled that the statute was constitutional. The motion to dismiss was denied. (Barker-Florida)
W70-09999

FRANKLIN V UNITED STATES (CONSEQUENTIAL DAMAGES FROM NAVIGATION IMPROVEMENT).

16 F Supp 253-260 (WD Tenn 1936).

Descriptors: *United States, *Mississippi River, *Alteration of flow, *Navigation, Tennessee, Navigable rivers, Projects, Legislation, Structures, Dikes, Obstruction to flow, Riparian rights, Riparian land, Damages, Flood damage, Relative rights, Governments, Channels, Eminent domain, Remedies, Judicial decisions, Legal aspects.

Plaintiffs sought recovery for damages caused their lands by flooding which was the result of a navigational improvement project on the Mississippi River. Defendant United States had erected dikes in the river upstream and across from plaintiffs' lands and had thereby changed the channel so that it was forced against the lands. Plaintiffs argued that the resulting flooding of their property was a taking within the meaning of the fifth amendment. Citing a long line of cases concerning governmental liability for navigation projects, the United States District Court for the Western District of Tennessee ruled that the damages to plaintiffs' lands were consequential, thus relieving the United States from liability. The court accepted the principle that riparian ownership on navigable waters is subject to the obligation to suffer the consequences of an improvement of the navigation by the United States. (Barker-Florida)
W70-10000

STATE V ADELMEYER (STATE'S RIGHT TO FLOW RIPARIAN LAND).
265 NW 838-848 (Wis 1936).

Descriptors: *Navigable waters, *Wisconsin, *Riparian rights, *Compensation, Judicial decisions, Legal aspects, Legislation, Eminent domain, Condemnation, Flow, Natural flow, Riverflow, Dams, Marshes, Land, Arable land, Land forming, Land use, Rivers, Governments, State governments, Riparian land, Flooding, Obstruction to flow, Reclamation, Alteration of flow.

Property owned by defendants comprised what once was a marsh. Defendants privately and individually constructed facilities which changed the course of a river, thus transforming the marsh into usable farmland. Twenty years after this transformation plaintiff state dammed the river, which again created a marsh, for the purpose of establishing a wildlife sanctuary. No compensation was made to landowners whose land was again inundated. Plaintiff sought a declaratory judgment to determine the rights of all parties in the marsh. Plaintiff contended that defendants had no right to change the course of a navigable river. Defendants answered that the state's acquiescence in the change estopped it from complaining or returning the river to its natural course without compensating defendants. The Supreme Court of Wisconsin ruled for defendants. The court found that the landowners' action had increased the navigability of the river and that the uncovered lands had taken on a new value and character. Consequently, the state could not flow such lands, despite the fact that the lands were naturally marsh, without compensating the owners. The measure of compensation was stated to be the difference between the values of the inundated and uninundated lands. (Dye-Florida)
W70-10001

NELSON V DE LONG (DEPRIVATION OF RIPARIAN RIGHTS APPURTENANT TO ALKESHORE PROPERTY).
7 NW2d 342-350 (Minn 1942).

Descriptors: *Minnesota, *Cities, *Lakes, *Regulation, Docks, Real property, Riparian rights, Riparian land, Judicial decisions, Legal aspects, Shores, Navigable waters, Easements, Condemnation, Recreation, Boats, Boating, Boating regulations, Permits, Local governments, Legislation, Navigation, Public rights, State governments, Supervisory control (Power).

Plaintiff, though not a riparian landowner, had been conveyed certain riparian rights which allowed the use of docks, boathouses and the shorefront of a lake. Due to increased usage of the shorefront by plaintiff and others, defendant village mayor undertook to regulate the use of the shores and the adjacent waters by having the city pass an ordinance which prohibited construction of boathouses and other structures. Plaintiff brought action for relief from this ordinance, alleging that such action was an arbitrary exercise of the defendant's power in denial of plaintiff's riparian rights. On appeal from a verdict for defendant, the court held that a riparian owner's rights are qualified, restricted and subordinate to the paramount rights of the public. The exercise of the state's public rights does not deprive the riparian owner of any right, but merely regulates and limits the exercise of existing rights. The state's soverign right to regulate may lawfully be delegated to a municipal corporation. Thus all regulation by defendant was found to be a lawful exercise of the village's governmental power. (Barnett-Florida)
W70-10002

STATE EX REL PRIEGEL V NORTHERN STATES POWER CO (ENJOINING DAM OPERATION AS A PUBLIC NUISANCE).
242 Wis 345, 8 NW2d 350-354 (1943).

Descriptors: *Wisconsin, *Dams, *Power head, *Fishkill, Fish management, State governments, Rivers, Diversion, Canals, Tailwater, Floodgates, Fishing, Streams, Administration, Administrative agencies, Navigable waters, Judicial decisions, Legal aspects, Legislation, Riparian rights, Natural flow, Powerplants, Impounded waters, Regulation, Public rights.
Identifiers: *Injunctions (Prohibitory).

Water from a river was diverted by defendant's dam through its power house. The water was then discharged into a storage pond. In time of flood, defendant opened the floodgates of its dam to allow excessive water to flow into the original river bed. When the gates were closed, fish were occasionally trapped in pools below the dam and were taken illegally or died from exposure. Plaintiff game warden brought action to enjoin the dam's operation as a public nuisance, alleging that the river was navigable, that the public had a right to fish and navigate thereon, and that said dam cut off the public rights in the river and restricted the flow of water in violation of state statute. Defendant answered that the Public Service Commission had conducted a hearing and had determined that the fish loss was insignificant in light of the cost of eliminating the loss. The court found that the state statute regulating the flow of water in the case of dams in navigable streams did not apply where the water was discharged directly into a storage pond. The loss of fish caused by the operation of the dam and the de minimis diversion was insignificant and could not justify the arbitrary enjoining of such operation and diversion as a nuisance. (Barnett-Florida)
W70-10003

OFFMASTER V TAGGART (PUBLIC RIGHT O FISH IN NAVIGABLE WATERS).

06 Mich 432, 11 NW2d 193-197 (1943).

escriptors: *Michigan, *Navigable rivers, *Fish-g, *Public rights, Fish conservation, Fish ocking, Dams, Trout, Judicial decisions, Legal spects, Meanders, Streams, Riparian rights, eneficial use, Riarian land, Ownership of beds, elative rights, Recreation, State governments, avigable waters, Real property, Proprietary ower, Land tenure.

efendants claimed that a stream that crossed their nd was non-navigable and thus not open to public shing. They excavated the channel of the stream here it entered and left their property for the pur-ose of making it impossible for fishermen to enter wading. Plaintiff brought action as a private tizen alleging that the stream was navigable and, eing navigable, was subject to the public's right to ke fish therefrom. Defendant contended that they ad done nothing to impede navigation and that in ny event they had the right to prevent trespasses n their property. The Supreme Court of Michigan, eversing the lower court, held that a stream which ould not be used for boating but had been used for oating logs, and in which the public had been fish-g for 50 years and on which the state had ex-ended large sums of money to stock it with fish as a navigable stream, and riparian owners could ot exclude the public from fishing therein. (Bar-ett-Florida)
70-10004

ABLEMAN V DEPARTMENT OF CONSERV. CONSTRUCTION OF STATE PARK AS VIOLA-ION OF RESTRICTIVE COVENANT ON AKEFRONT PROPERTY).

09 Mich 416, 15 NW2d 689-691 (1944).

escriptors: *Michigan, *Lakes, *Land use, *Fish-g, Leases, Eminent domain, Shores, Riparian ghts, Judicial decisions, Legal aspects, Conserva-on, Administrative agencies, Regulation, Boats, oads, Landfills, Scenery, Natural resources, ublic benefits, Boat-launching ramps, Relative ghts, Real property, Land tenure, Land classifica-on, Parks.
dentifiers: *Injunction (Prohibitory), *Nuisance.

laintiff was the owner of lakefront property in a ubdivision which was subject to restrictive cove-ants. Defendant, pursuant to its policy of making e waters of the state available to the public, urchased four lots adjacent to plaintiff's property be used as a small state park for the launching of shing boats. Plaintiff complained that a fishing site as contrary to the restrictions upon the use of the roperty and to the general plan in existence in the ubdivision. The lower court found the subdivision be strictly residential and enjoined defendant's cts as a violation of the restriction on the use of e land. The appellate court found, upon examina-on of the record, that the land was not strictly re-dential in that a boat livery had been in existence non-conformity with the residential plan. Since e plan had not been rigidly followed, defendant as not bound to it. Defendant's acts in establish-g a public fishing site were proper and did not onstitute a nuisance which could be enjoined. Barnett-Florida)
70-10005

OARD OF TRUSTEES V BOARD OF UPR'VSRS (COMPULSORY CONTRIBUTION Y DRAINAGE DISTRICTS FOR MAIN-ENANCE OF COMMON FACILITIES).

9 NW2d 196-201 (Iowa 1945).

escriptors: *Cost sharing, *Drainage districts, Drainage systems, *Iowa, Administrative agen-es, Administration, Judicial decisions, Legal spects, Administrative decisions, Costs, Public enefits, Assessments, Ditches, Outlets, Laterals, qualizing reservoirs, Rivers, Missouri River, Drains, Dikes, Regulation, Operation and maintenance, Financing, Cost allocation.

Plaintiff drainage district's main ditch extended north and south approximately 21 miles. Defendant districts was situated north of plaintiff. Plaintiff contended said districts were outleting their drainage into its main ditch. Plaintiff had certain repairs and maintenance operations performed in its district which were necessary to carry off the combined waters of the various districts. Plaintiff brought suit to compel the upper districts to levy assessments to pay their share of the expense of maintaining the alleged common outlet. Defendants contended that their districts did not outlet into plaintiff's ditch, but rather that they discharged their drainage into nearby natural streams. The lower court held for plaintiff, finding that defendants did in fact outlet into plaintiff's ditch. The Supreme Court of Iowa affirmed, stating that defendants' natural stream outlets did not furnish satisfactory outlets. Moreover, it held that since plaintiff's ditch provided defendants with a deeper and more adequate outlet to discharge their drainage water into, defendants could be compelled to make assessments for the maintenance thereof. (Barnett-Florida)
W70-10006

HICKS V ANDERSON (LANDOWNER'S RIGHT TO HAVE PROPERTY CONDEMNED AFTER DAMAGE RESULTS FROM STATE ACTION).
182 Va 195, 28 SE2d 629-630 (1944).

Descriptors: *Virginia, *Condemnation, *Flooding, *Administrative agencies, Judicial decisions, Flow, Administration, Legal aspects, Governments, State governments, Eminent domain, Surface runoff, Highways, Roads, Highway relocation, Road construction, Culverts, Surface drainage, Rain, Erosion, Arable land, Land, Damages, Flood damage, Rain water, Remedies.

Plaintiff landowner sought a writ of mandamus to compel defendant State Highway Commissioner to institute condemnation proceedings on plaintiff's property which was injured by floodwaters. Plaintiff contended that the damage resulted from construction of a state road which diverted water onto his land. Defendant contended that the damage resulted from the natural flow of surface water over plaintiff's property. The Supreme Court of Appeals of Virginia held for plaintiff and issued the writ. One of whose property is damaged as a result of highway construction may not sue the commonwealth; his only remedy is through condemnation. A landowner is entitled to compensation for property damage resulting from flowage diverted onto his land by a public highway. (Dye-Florida)
W70-10007

ADAMS V CAREY (DAMAGE TO OYSTER BEDS CAUSED BY FERRYBOAT RUNNING AGROUND).
190 A 815-822 (Md 1937).

Descriptors: *Maryland, *Boats, *Oysters, *Damages, Beds, Navigation, Fog, Channels, Harbors, Navigable waters, Ships, Ownership of beds, Beds under water, Riparian rights, Permits, Legal aspects, Judicial decisions, Relative rights, Remedies, Commercial shellfish, Shellfish, Mollusks.

In a fog defendant's ferryboat ran aground on a shoal and, in an attempt to free itself, damaged plaintiff's oyster beds. The appellate court felt that there was no negligence in attempting to navigate the vessel during the fog, as the ferryboat had a responsibility to get its passengers across the channel regardless of the weather. However, the jury had found that the ferryboat operator did not use reasonable care in his efforts to free the boat from the shoal, which efforts damaged the beds and covered many oysters with sand, and the court declined to disturb this finding. The lower court decision was reversed, however, because of the lower court's failure to give instructions on the effect of defendant's paramount right of navigation, and failure to require the jury to find whether defendant knew or should have known that his actions in freeing the boat would damage the beds. Plaintiff's property rights in the oyster bed were held to be subject to ordinary dangers incident to navigation. Therefore, the fact that the beds were damaged by defendant's ferryboat did not of itself give rise to damages. (Caldwell-Florida)
W70-10008

CONWAY V NEW HAMPSHIRE WATER RES BD (CONSTITUTIONALITY OF LEGISLATION SETTING UP A WATER RESOURCE DEVELOPMENT PROGRAM).
199 A 83-90 (NH 1938).

Descriptors: *New Hampshire, *Legislation, *Administrative agencies, *Water resources development, Project purposes, Public benefits, Hydroelectric power, Flood control, Water storage, Project benefits, Governments, Taxes, Legal aspects, Remedies, Judicial decisions, Water utilization, Hydroelectric project licensing, Costs, Multiple-purpose projects.
Identifiers: *Constitutionality.

Petitioners brought a taxpayers' suit to enjoin expenditure of state funds for a water resource development program. Petitioners claimed that the legislation setting up the program was unconstitutional in that the projects were not for a public purpose. The court rejected the claim, holding that the program did involve a public purpose. Development of hydroelectric power and flood control were specifically pointed to as examples of benefits accruing to the public. The court held that the planned private use of the power, developed from storing water and employed in producing electric energy, was not a forbidden aid to private industry because the private benefits were merely incidental to the public purposes involved. No elements of a commercial enterprise were found in the program, and sufficient standards were laid down by the statute to guide the defendant board in the implementation of the program. (Caldwell-Florida)
W70-10009

MAYOR AND CITY COUNCIL OF HAVRE DE GRACE V MAXA (CITY'S LIABILITY FOR DAMAGES TO RIPARIAN OWNER CAUSED BY NEGLIGENT CONSTRUCTION OF RETAINING WALL).

9 A2d 235-243 (Md 1939).

Descriptors: *Maryland, *Excavation, *Retaining walls, *Riparian rights, Bays, Judicial decisions, Legal aspects, Local governments, Cities, Riparian land, Riparian waters, Water rights, Bulkheads, Concrete piles, Landfills, Land forming, Marinas, Easements, Access routes, Compensation, Value, Real property, Property values, Project planning, Planning.

Plaintiff riparian owner brought action against defendant city to recover damages for injuries sustained when dredged material deposited behind a retaining wall erected by the city in constructing a yacht basin escaped and became deposited along the shore adjoining plaintiff's property, thereby depriving plaintiff of his access to the bay. Plaintiff's evidence showed that the retaining wall was obviously insufficient and that defendant had been warned by its employees that damages to riparian owners were probable. Plaintiff contended that such evidence established defendant's negligence and liability. Defendant contended that it was not liable for the negligence of its subcontractors and that it was immune to liability since it was a municipal corporation engaged in a governmental function. Affirming a judgment for plaintiff, the court held that the subcontractor was only bound to perform according to his contract whereas defendant had a duty to plan the project so that riparian owners would be protected. The court further

held that governmental immunity did not apply to defendant where there was evidence of specific negligent acts. The court also noted that the proper measure of damages was the difference between fair market value before and after the injury, including any damage to plaintiff's personal enjoyment and use of the property. (Liptak-Florida)
W70-10010

UNITED STATES V 2.02 ACRES OF LAND (CONDEMNATION OF WATERFRONT PROPERTY).
51 F Supp 56-61 (SD NY 1943).

Descriptors: *New York, *Land tenure, *Condemnation value, *Eminent domain, Condemnation, United States, Governments, Landfills, Public lands, Cities, Parks, Land use, Military reservations, Military aspects, Grants, Judicial decisions, Legal aspects, Sea walls, State governments, Local governments, Federal government, Compensation.

In a condemnation proceeding the United States sought valuation of certain waterfront lands owned by a city and a county. The state of New York sought to take part in the award on the grounds that the original grant whereby the underwater land was conveyed contained a reverter provision which would become operative if the land were not filled and used for public park purposes. New York claimed that the taking suspended the public use and that title thereby reverted to the state. The United States District Court for the Southern District of New York ruled that the conditions of the grants were not violated when the federal government first leased and then later condemned the lands. Title was held to be in the city and county and the full award was given to them alone. (Barker-Florida)
W70-10011

WILLIS V UNITED STATES (COMPENSATION FOR FLOODING OF RIPARIAN LAND CAUSED BY FEDERAL DAM CONSTRUCTION).
50 F Supp 99-102 (SD W Va 1943).

Descriptors: *United States, *West Virginia, *Dam construction, *Eminent domain, Dams, Damsites, Damages, Flooding, Reservoirs, Navigable rivers, High-water mark, Riparian land, Erosion, Riparian rights, Banks, Boundaries (Property), Water level fluctuations, Compensation, Economic impact, Value, Governments, Remedies, Judicial decisions, Legal aspects, Legislation.
Identifiers: *Tucker Act, *Cribbing.

Plaintiff riparian landowner sought to recover for lands flooded as a result of defendant United States' construction of a dam below his property. Plaintiff contended that the dam construction had raised the water level of the river abutting his property above the ordinary high-water mark and that recovery was authorized by the Tucker Act. Plaintiff further claimed damage to cribbing placed at the old river edge to prevent erosion. The United States claimed that the reservoir level was not above the ordinary high-water mark and that the cribbing had become useless and thus had no value. The United States District Court, Southern District of West Virginia, ruled that the government had raised the water level above the ordinary high-water mark thus flooding plaintiff's land, and that the inundated cribbing was functional. An award for the flooded land taken and the damage to the cribbing was granted to the plaintiff. (Barker-Florida)
W70-10012

GRANT V TENNESSEE VALLEY AUTHORITY (IMMUNITY OF GOVERNMENTAL AGENCY FROM SUIT).

49 F Supp 564-567 (ED Tenn 1942).

Descriptors: *Tennessee, *United States, *Tennessee Valley Authority Project, *Damages, Navigation, Navigable rivers, Tennessee River, Dams, Damsites, Multiple-purpose projects, Project planning, Legislation, Governments, Hydroelectric power, Hydroelectric plants, Project purposes, Flooding, Crops, Benefits, Remedies, Judicial decisions, Legal aspects, Political aspects, Direct benefits, Project benefits.
Identifiers: *Immunity (Governments).

Plaintiff landowner sued the Tennessee Valley Authority for alleged negligence in its operations, by which plaintiff's crops were damaged. Defendant, in a motion for summary judgment for failure to present justiciable facts, claimed immunity from the suit. The United States District Court for the Eastern District of Tennessee ruled that if damage did occur to plaintiff, it stemmed from the government's power over navigation, and that the government is only answerable in damages when it engages in activities as a private citizen. The court further held that defendant was merely an agent of the federal government and thus enjoyed the same immunity from suit. The motion for summary judgment was granted. As dicta, the court noted that plaintiff had actually been benefited by defendant's operations, since without the project's existence, the flood damage would have been greater than it was. (Barker-Florida)
W70-10013

RICHARD V KAUFMAN (DAMAGE TO SPRING CAUSED BY BLASTING OPERATIONS).

47 F Supp 337-339 (Ed Penn 1942).

Descriptors: *Pennsylvania, *Explosions, *Adjudication procedure, *Springs, Explosives, Damages, Spring waters, Subsurface waters, Water sources, Excavation, Hazards, Deformation, Remedies, Judicial decisions, Legal aspects, Tunnel construction, Tunneling, Tunnels.

Plaintiff landowner brought an action to recover for damage to a spring allegedly caused by defendant's tunneling and blasting operations on adjacent property. Defendant construction company argued that the blasting was not the direct cause of the damage to the spring. The trial jury ruled in favor of plaintiff and the U. S. District Court for the Eastern District of Pennsylvania, affirmed, holding that the question as to whether the blasting operations caused the damage to the spring was properly submitted to the jury for determination. Moreover, testimony by two witnesses concerning the flow of the spring was properly admitted. (Barker-Florida)
W70-10014

MUTUAL CHEMICAL CO OF AMERICA V MAYOR AND CITY COUNCIL OF BALTIMORE (RELATIVE BULKHEAD--FILL RIGHTS).
33 F Supp 881-891 (D Md 1940).

Descriptors: *Maryland, *Cities, *Bulkhead line, *Relative rights, Riparian rights, Navigation, Piers, Landfills, Land forming, Airports, Runways, Administrative agencies, United States, Governments, Permits, Regulation, Planning, Banks, Riparian land, Ownership of beds, Remedies, Judicial decisions, Legal aspects, Land tenure, Contracts.

Plaintiff landowners brought suit to have the extent of their riparian ownership along a river established and to enjoin the City of Baltimore from encroaching on those rights. The bulkhead and pier lines in the river had been established by the United States government. The city sought and was granted a permit to fill to those lines in order to build an airport, and an agreement between the city and surrounding landowners was established whereby the relative riparian rights concerning the bulkhead lines were agreed upon. When the city later sought to expand the airport, a new plan, which expanded the city's rights, was proposed to the landowners. Plaintiff's who had acted substantially in reliance on the old plan, brought suit. The United States District Court of Maryland ruled that where the city had adopted a plan for apportioning the harbor line to owners of an irregular shore, a such plan fixed the city's riparian rights, the c could not thereafter adopt a new plan giving its additional riparian rights and curtailing the ripari rights of the other shore owners. The injunctio was granted. (Barker-Florida)
W70-10015

GOODMAN V UNITED STATES (DAMAG FROM GOVERNMENT'S NAVIGATION PRO JECT).
28 F Supp 497-504 (S D Iowa 1939).

Descriptors: *Iowa, *Missouri River, *Floo damage, *Eminent domain, United States, Gover ments, Navigable rivers, Navigation, Projects, Pr ject purposes, Water policy, Damages, Floodin Structures, Piles (Foundations), Diversion stru tures, Sedimentation, Sediment control, Legisl tion, Remedies, Crops, Riparian rights, Judici decisions, Legal aspects, High-water mark.
Identifiers: *Revetments, *Tucker Act.

Plaintiff riparian landowner on the Missouri Riv brought action to recover damages stemming fro a United States government project to improv navigation on the River. The United States ha erected pile dikes and revetments in the River an the resulting higher water level flooded plaintiff land destroying his crops. Plaintiff alleged suc damage was a taking under the fifth amendmer and sought recovery under the Tucker Act for case not sounding in tort. The United States Di trict Court for the Southern District of Iowa rule that, in such an action, recovery can be given onl where the government contemplated damage would result from its activity and an implied con tract can be found. The court further held tha plaintiff's damages were consequential and tempo rary, thus removing the case from the purview o the Tucker Act and making the United States im mune from the suit. (Barker-Florida)
W70-10016

HUMBOLDT LOVELOCK IRR LIGHT AND POWER CO V SMITH (STATE REGULATION OF RIVER WATER DIVERSION).

25 F Supp 571-575 (D Nev 1938).

Descriptors: *Nevada, *Adjudication procedure *Prior appropriation, *Administrative decisions Appropriation, Preferences (Water rights), Priorities, Water rights, Administrative agencies, State governments, Legal aspects, Judicial decisions, Reservoirs, Irrigation water, Hydroelectric power, Livestock, Water demand, Regulation, Intake gates, Diversion, Arid climates, Distribution, Supervisory control (Power).

Plaintiff corporation owned a reservoir constructed for the purpose of impounding surplus and unappropriated waters of the Humboldt River. Subsequent to impoundment the waters were used by the corporation's stockholders for irrigation, livestock and power purposes. Pursuant to his statutorily granted authority to regulate diversions from the Humboldt River, defendant state engineer closed the intake gates to plaintiff's reservoir system. Plaintiff sued, contending that the statutory procedures for such closing denied it due process. The United States District Court dismissed the case, holding that the statute in question did provide such full opportunity to be heard as would satisfy due process requirements. Moreover, the court noted that arid and semi-arid states, in the exercise of their police power, may regulate the manner of appropriation and distribution of water from natural streams for purposes of irrigation. (Marsee-Florida)
W70-10017

ADAMS-MCGILL CO V HENDRIX (OWNERSHIP OF SPRING).
22 F Supp 789-792 (D Nev 1938).

escriptors: *Nevada, *Springs, *Land tenure, Water rights, Boundaries (Property), Relative ghts, Legislation, Surveys, Water utilization, Con- acts, Legal aspects, Grazing, Real property, aims (Contracts).

on default by defendant purchaser on a land ntract, plaintiff vendor brought an action to cover the purchase price. The purchaser de- nded by alleging that a certain spring, the rights which were included in the contract, were not ned and could not be delivered by plaintiff. The urt held that, in light of the great value of spring hts in an arid land and the fact that the rights re protected by statute, such rights could be con- ered as real property. However, the contract tween plaintiff and defendant contained no war- nty clause, and the court found that the plaintiff d only contracted to deliver such rights to the ring as he possessed, which were none. Plaintiff s held to be entitled to recover. (Caldwell- rida)
70-10018

NNESSEE ELECTRIC POWER CO V TVA ALIDITY OF FEDERAL PROJECTS UNDER IE TVA ACT OF 1933).
F Supp 947-961 (ED Tenn 1938).

scriptors: *Tennessee Valley Authority Project, am construction, *Public utilities, *Hydroelec- plants, Hydroelectric power, Remedies, gislation, Flood control, Project purposes, Legal ects, River basin development, Dams, Compet- uses, Judicial decisions, Administrative agen- s, Federal government, Cities, Electric power duction, Damages, Navigation, State govern- nts, Water storage, Multiple-purpose projects. ntifiers: *Constitutionality.

intiffs, private electric power companies, sought enjoin construction and operation of any TVA droelectric project. Plaintiffs in essence claimed t the TVA Act of 1933 and the acts performed the Authority were unconstitutional. In the irse of a comprehensive discussion of the ckground of the TVA program, the Federal Dis- ct Court found that the purposes of the dams in estion were electric power production, flood ntrol, and National Defense. The Act was held nstitutional under the national defense clause of Constitution and under the power of Congress control navigation under the Commerce clause. conspiracy, coercion, or unlawful competition, alleged by plaintiffs, were found to exist. Both existing and planned operations of the dams re found to be in compliance with the statute. e court held that since the United States had uired the sites and constructed the dams legally, energy produced therefrom was property be- ging to the United States. This property could legally sold just as any other government proper- The complaint was therefore dismissed. (Cald- ll-Florida)
70-10019

ITED STATES V POWER COUNTY, IDAHO TTEMPT BY COUNTY TO TAX UNITED ATES PROPERTY).

F Supp 684-688 (D Idaho 1937).

scriptors: *Taxes, *Land tenure, *United States, aho, Condemnation, Reservoirs, Assessments, ter storage, Federal government, Legal aspects, deral reservations, Judicial decisions, Real pro- ty, Local government, Cities, Flooding.

en it appeared that a small town in Idaho was to inundated by a new federal reservoir, the United tes acquired, by purchase and condemnation, rby land on which to construct a new town. bsequently, the county sought to tax the equita- interest in the land of the local American Falls servoir District. The United States protested the essment, as it still held legal title to the property. e court held that title had vested in the United States upon acquisition of the land, and could not be divested except by Congressional action. The land therefore belonged to the United States and was immune from local taxation. (Caldwell-Florida)
W70-10020

HAGIE V LINCOLN LAND CO (CHARGE OF POINT OF DIVERSION FROM STREAM CLAIMED TO BE ABANDONMENT OF RIGHT TO DIVERT).
18 F Supp 637-641 (D Wyo 1937).

Descriptors: *Water rights, *Prior appropriation, *Wyoming, *Diversion, Priorities, Streams, Ditches, Alteration of flow, Dams, Water utilization, Irrigation, Competing uses, Relative rights, Legislation, Beneficial use, Water supply, Consumptive use, Preferences (Waterrights), Irrigation water, Groundwater movement, Percolation, Land use, Legal aspects, Adjudication procedure.

Defendant had previously established an appropriative right to divert water from the main channel of a stream. When defendant closed his original point of diversion and built a dam farther downstream on his property for irrigation purposes, plaintiff, a downstream landowner, claimed abandonment of defendants' right to divert. The court in holding for the defendant found that plaintiff could not maintain his suit because he could not show that he would be benefitted by a declaration of abandonment. Other intervening riparian owners had unfulfilled priorities which would more than take over any water which defendant would forfeit. The court further found that, even though the original diversion point had been closed, there had been no abandonment. Defendant had built a dam downstream, which caused water to percolate onto his fields, an unusual but effective means of irrigation. The complaint was therefore dismissed. (Caldwell-Florida)
W70-10021

HOLYOKE WATER POWER CO V AMERICAN WRITING PAPER CO (CONTRACT PROHIBITING POWER TRANSMISSION FROM LAND GRANTED).
17 F Supp 895-899 (D Mass 1936).

Descriptors: *Hydroelectric power, *Dams, *Contracts, *Canals, Mills, Water contracts, Electric power, Hydroelectric plants, Transmission (Electrical), Electric power production, Water utilization, Mill dams, Land tenure.

Complainant sought to enjoin respondent from transmitting elsewhere electric power produced on respondent's millsite. Complainant had granted respondent's predecessors in interest the millsite and the right to a certain amount of water power. A clause in the contract provided that the power produced on the millsite was to be used only on the land on which the mill was located, and complainant contended that this clause prohibited transmission of electric power generated on the site to other locations. The court rejected this contention. While stating that electricity was essentially an improved means for the transfer of power and not a separate commodity, the court held that the original limitation had only the purpose of assuring complainant a specified place to deliver the water, and did not prevent respondents from transmitting electric power. (Caldwell-Florida)
W70-10022

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, BRAZOS AND BOSQUE RIVERS, WACO, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W70-09536

SUGGESTIONS FOR A MODEL FLOOD PLAIN ZONING ORDINANCE,
William Hines, J. W. Howe, and Dick Montgomery.
Land and Water Law Review, Vol. 5, p 321-350 (1970). 30 p, 66 ref, 1 append.

Descriptors: *Flood plain zoning, *Legislation, *Flood protection, *Land use, Regulation, Flood control, Flood damage, Flood plains, Rivers, Governments, Public benefits, Legal aspects, Political aspects, Economics, Obstruction to flow, Local governments, Zoning, Project purposes, Floodways, Planning, Data collections, Rational formula, Land classification, Building codes, Structures.

Despite the construction of extensive flood protection devices, annual flood losses have continued to rise. The author contends that flood plain regulations directed toward control of property and structures within flood plains are necessary to reduce flood damage. Such measures would be constitutional as necessary for the public welfare even though they restrict the use of property within the affected area. The model statute suggested by the author would classify the flood plain into three districts: floodways, flood plain districts, and upland districts. Floodways, the river channel and the area immediately adjoining the channel, would be subject to restrictions preventing any use which would obstruct the efficient carrying away of flood waters. The other two districts would be subject to respectively less stringent ristrictions. The delineation of district boundaries, based on the maximum probable flood, may be very difficult, and local authorities should avail themselves of data available from state and federal agencies. (Caldwell-Florida)
W70-09785

FLOOD PLAIN INFORMATION, PARKER CREEK, MARSHALL, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W70-09845

FLOOD PLAIN INFORMATION, LITTLE WEKIVA RIVER, ORANGE COUNTY, FLORIDA.
Corps of Engineers, Jacksonville, Fla.
For primary bibliographic entry see Field 04A.
W70-09846

6G. Ecologic Impact of Water Development

POSSIBILITIES FOR BENEFICIAL USES OF HEATED WATER DISCHARGES INTO COOLING RESERVOIRS,
Missouri Univ., Columbia. Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W70-09596

ECOLOGY-ITS PLACE IN WATER MANAGEMENT,
Michigan Univ., Ann Arbor. School of Natural Resources.
Stanley A. Cain.
In: Water Spectrum, Issues, Choices, Actions, Vol. 1, No. 1, Summer 1969, p 10-14. 1 photo.

Descriptors: *Ecology, *Environment, *Water management, Water resources, Natural resources, Environmental effects, Watershed management, Sequence.
Identifiers: *Interrelations, *Sequences of change.

The author discusses ecology and its place in the management of natural resources, specifically water resources. The ecological approach is concerned with interrelations among living things and their environment, sequences of change in an environment, and interconnections between one environmental site and another. This approach differs from the traditional cause-and-effect approach

which views elements separately. These ideas are related to water resources management with the stream seen as a creature of the watershed, the entire land surface that provides water drainage into the stream. A change in any part of the watershed may affect a sequence of interrelated changes in the rest of the watershed. Some examples are given where the ecological approach was not used and effects have been detrimental to man's ecology which, in effect, encompasses all ecology. Greater application of ecological foresight to management of water and other related natural resources can help us avoid disasters in the future and assure a more productive environment. (Marriott-Chicago)
W70-09645

SOME HYDROLOGIC AND BIOLOGIC ASPECTS OF THE BIG CYPRESS SWAMP DRAINAGE AREA, SOUTHERN FLORIDA,
Geological Survey, Tallahassee, Fla. Water Resources Div.
For primary bibliographic entry see Field 04A.
W70-09704

ESTUARINE CONSERVATION LEGISLATION IN THE UNITED STATES,
Milton S. Heath, Jr.
Land and Water Law Review, Vol. 5, p 351-390 (1970). 40 p, 61 ref. 1 append.

Descriptors: *Conservation, *Legislation, *Estuarine environment, *Estuaries, Ecology, Wetlands, Water pollution, Aquatic habitats, Coasts, Preservation, Permits, Regulation, Marshes, Administrative agencies, Legal aspects, Judicial decisions, State jurisdiction, Programs, Dredging, Natural resources, Marsh management, Adoption of practices, Adjudication procedure, Florida, California.

Estuarine areas are being threatened by pollution and by physical alterations by man that reduce acreage of estuarine marshes and open waters. Presently, the only federal regulation of activities affecting these areas is the system of permits administered by the Army for projects affecting navigable waters. Several coastal states have legislative programs regulating dredging or filling, establishing bulkhead lines, and setting up zoning criteria. Some states also have provisions for acquiring estuarine areas for public use. Court decisions concerning the validity of state legislation restricting the use of estuarine property have been split. The author examines several state programs for estuarine conservation, including California and Florida. In addition to the provisions listed above, these legislative frameworks include fish and game regulation and use permits. The author presents a suggested state law for control of estuarine areas. This statute would include a broad permit system for any use of these areas and would provide for a comprehensive study of estuarine environment problems. (Caldwell-Florida)
W70-09786

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969.
For primary bibliographic entry see Field 06E.
W70-09789

TODAY THE ENVIRONMENT, TOMORROW THE WORLD,
Michigan Univ., Ann Arbor. Dept. of Wildlife and Fisheries.
Frederick E. Smith.
Bioscience, Vol 19, No 4, p 317-320, April 1969.

Descriptors: *Ecosystems, *Nutrient requirements, *Transpiration, Soil-water-plant relationships, *Productivity, Ecology, Arid lands, Tropical regions, Grasslands, Forests, Agriculture, Biomass, Aquatic plants, Aquatic productivity, Energy transfer, Erosion, Streamflow.
Identifiers: *Population ecology, *Temperate zones, *Protein production, *Calorie production, *Ecosystem alteration, Nutrient status.

Since we are accelerating ecosystem exploitations, we must recognize their limitations as well as potentialities. Predation increases protein production while plant consumption increases calorie production. An increase in the production of one leads to a decrease in the other. Since world protein deficiency is currently greater than calorie deficiency, grasslands should not be replaced by crops because this leads to a decline in animal protein production. Similar problems exist between water quality and water quantity. Forest ecosystems transpire high quality water and their destruction leads to greater runoff, but of lower quality water. In terrestrial plants 95-99 percent of all utilized solar radiation supports nutrient transport via the mechanism of transpiration. Arid lands suffer least in this respect because soil nutrients are more evenly dispersed with the consequence of many irrigation projects in these areas. However, all such irrigation projects have ultimately failed due to soil salt accumulation. In humid tropical areas, nutrients lie on the surface in low concentrations with consequent high transpiration rates. Agricultural potential is limited because the nutrients soon wash away after destruction of native vegetation. Man's most successful ecological alterations have been the conversions of forests to grasslands. (Casey-Arizona)
W70-09953

PRECIPITATION MODIFICATION IN SEMIARID AND ARID REGIONS,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
For primary bibliographic entry see Field 03B.
W70-09959

INFERENCES FROM ECOLOGICAL THEORY,
Michigan Univ., Ann Arbor. Dept. of Resource Planning and Conservation.
For primary bibliographic entry see Field 03B.
W70-09960

07. RESOURCES DATA

7A. Network Design

POTOMAC RIVER WATER QUALITY NETWORK, COMPILATION OF DATA-WATER YEAR 1969.
Interstate Commission on the Potomac River Basin, Washington, D.C.
For primary bibliographic entry see Field 05A.
W70-09557

THE CONTROL OF RIVER HEATING BY ACCURATE DIGITAL SIMULATION,
Motor-Columbus Engineering Co., Baden (Switzerland).
For primary bibliographic entry see Field 05G.
W70-09594

PRINCIPLES FOR DISTRIBUTION AND PROSPECTS FOR DEVELOPMENT OF A HYDROLOGIC NETWORK,
I. F. Karasev.
Trans. from Trudy Gossuder. Gidrolog. Instituta, No. 164, 1968. Soviet Hydrology: Selected Papers, Issue No 6, 1968, p 560-588. 29 p, 3 fig, 2 tab, 23 ref.

Descriptors: *Hydrologic aspects, *Rivers, *Lakes, *Reservoirs, *Optimization, Runnoff, Water balance, *Distribution patterns.
Identifiers: Base stations (Posts), Water regime.

A network of hydrologic posts was used to study the regime of land waters and to obtain regularly information on processes in bodies of water. The hydrologic network included (1) base stations (posts) for systematically observing the hydrologic regime of rivers, lakes and reservoirs; (2) special stations (posts) for studying the local characteristics of the water regime, conditions of forma tion of runoff and elements of the water balanc (3) various kinds of networks and (4) expeditions ry (temporary) posts designed for detailed study c hydrologic processes. The special network was a ranged and operated in accordance with researc programs. Examination of the principles for di tribution of the basic networks was the main obje tive. The information received from the networ included data on water levels, discharges and sed ment, water temperature and ice phenomena. Th optimum structure of the observation system wa governed by tests of economic efficiency in th branches of the national economy using hydrologi data. (See also W-6908734) (Kriss-Cornell)
W70-09828

PROGRAM OF THE WATER RESOURCE DIVISION, TEXAS DISTRICT FOR THE 197 FISCAL YEAR AND SUMMARY OF DISTRIC ACTIVITIES DURING FISCAL YEAR 1969.
Geological Survey, Austin, Tex. Water Resource Div.
For primary bibliographic entry see Field 09D.
W70-09836

7B. Data Acquisition

DELINEATION OF LINEAR FEATURES AN APPLICATION TO RESERVOIR ENGINEER ING USING APOLLO 9 MULTISPECTRA PHOTOGRAPHY,
Geological Survey, University, Ala.
W. J. Powell, C. W. Copeland, and J. A. Drahovzal
Alabama Geological Survey Information Series 4 1970. 37 p, 13 fig, 3 tab, 6 ref.

Descriptors: *Remote sensing, *Water resource *Infrared radiation, *Structural geology Hydrogeology, Groundwater, Streamflow, Lo flow, Springs, Water wells, Water yield, Fault (Geology), Alabama, Appalachian Mountain Re gion.
Identifiers: *Lineations, *Multispectral photog raphy, Apollo 9.

Four multispectral photographs of east centra Alabama were made by the crew of the Apollo spacecraft. The photographs cover a 6,400 squar mile area (about 80 x 80 miles square) betwee Birmingham, Alabama, and the Georgia Stat boundary. The most significant features observe on the photographs are the relatively straight lon lineations that intersect Appalachian structura axes. Because little or no offset in topographic fea tures is evident along most of the traces, the linea tions are thought to represent fractures. Apparen coincidence of the linear features with areas c known anomalies of streamflow, of large capacit wells and springs, quarry drainage, and dar leakage problems indicate that lineations may hav not only a marked geologic effect but also may b of great hydrologic, environmental, and economi significance. The interpretations made of th photographs indicate the following application (1) Determining areas of groundwater movemen (2) Determining areas where large quantities c groundwater are available; (3) Determining area for making low-flow measurements; (4) Determin ing areas for locations of gaging stations; (5) Loca ing sites of optimum hydrogeologic conditions fo the construction of dams and reservoirs; (6) As a aid in geologic mapping; and (7) As an aid in th study of structural geology of an area. (Knapp USGS)
W70-09537

PHYSICAL STUDIES OF NATURE BY THER MAL MAPPING,
Research Inst. of National Defense, Stockholm (Sweden); and Lund Univ. (Sweden). Dept. c Physical Geography.
E. Fagerlund, B. Kleman, L. Sellin, and H. Svensson.
Earth-Science Reviews, Vol 6, No 3, p 169-18(June, 1970. 12 p, 14 fig, 1 tab, 4 ref.

escriptors: *Remote sensing, *Infrared radiation, Mapping, Surveys, Photometry, Terrain analysis, nstrumentation.
dentifiers: *Thermal mapping, Sweden.

hermal mapping by airborne equipment makes it ossible to trace and detect processes and proper-es which have their most distinct radiation haracteristics in the infrared part of the spectrum. or discipline of the earth sciences, such as physi-al geography, geology, climatology (especially icro- and mesoclimatology) and hydrography hich work by collecting and analyzing data from round and water surfaces, thermal mapping epresents a scientific tool for gathering informa-on earlier inaccessible. (Knapp-USGS)
70-09540

HE AIRBORNE INFRARED SCANNER AS A EOPHYSICAL RESEARCH TOOL,
eological Survey, Washington, D.C.
les D. Friedman.
ptical Spectra, Vol 4, No 6, p 35-44, June 1970. p, 12 fig, 1 tab, 22 ref.

escriptors: *Remote sensing, *Infrared radiation, eophysics, Monitoring, Water pollution sources, hermal pollution, Geology, Solar radiation, Heat ansfer.
dentifiers: Infrared scanners.

he key role of airborne infrared line-scan imaging stems in geophysical exploration and environ-ental control is to record temporal and spatial riations in broadband thermal emission from the rth's surface. Correlation of these variations with nvective heat flow anomalies, resistivity lows, ermal pollution, and occurrence of icroearthquakes is just beginning to pay vidends in volcanology, in exploration, in pollu-on monitoring, and development of geothermal ower sources. In planning precise airborne sur-eys of radiant flux from the earth's surface ac-unt must be taken of background noise created variations in micrometeorological factors and nissivity of surface materials, as well as the diur-l temperature cycle. The effect of the diurnal cle may be minimized by planning predawn aeri-surveys. (Knapp-USGS)
70-09541

IELD METHODS FOR MEASUREMENT OF LUVIAL SEDIMENT,
eological Survey, Washington, D.C.
r primary bibliographic entry see Field 02J.
70-09550

NALYSIS OF A RECONNAISSANCE GRAVI-Y SURVEY FOR DRIFT-FILLED VALLEYS IN HE MERCER QUADRANGLE, PENNSYL-ANIA,
aval Oceanographic Office, Washington, D.C. agnetics Div.; and Pennsylvania State Univ., niversity Park. Dept. of Geology and Geophysics.
r primary bibliographic entry see Field 02F.
70-09686

VALUATION OF SELECTED COBALT-60 OMPLEXES AS TRACERS OF GROUND-ATER,
ortheast Louisiana State Coll., Monroe. Dept. of hemistry; and Agricultural Research Service, Ox-rd, Miss.
rank N. Bruscato, and J. Roger McHenry.
ournal of Hydrology, Vol 10, No 4, p 406-417, ne 1970. 12 p, 3 fig, 6 tab, 16 ref.

escriptors: *Tracers, *Cobalt radioisotopes, Groundwater movement, Ion exchange, Clay inerals, Laboratory tests, Radioisotopes, adioactivity techniques, Translocation.
dentifiers: Complexes.

series of Co-60 compounds, considered as poten-ally useful tracers of groundwater movement, ere prepared and evaluated in soil column and batch studies. The compounds were: potassium hexacyanocobaltate (III), potassium ethylenediam-minetetraacetato-cobaltate (III), ammonium 12-tungstodi-cobaltoate (III), chloraquotetrammine cobalt (III) chloride, and sodium hexanitrocobal-tate (III),. The performance of the complexes of CN and EDTA were dependent on their environ-ment and more especially on the type and amount of clay present. The EDTA cobalt complex cannot be used in soils that bare basic or where a large fraction of the clay is saturated with Na or Ca. Of the other radioactive tracers tested, none were suited for groundwater tracing because of instabili-ty in aqueous solution, variable anionic structure under acid conditions, or preferential uptake by the clay fraction. (Knapp-USGS)
W70-09691

AN EXACT METHOD FOR CHARACTERIZA-TION OF GRAIN SHAPE,
Michigan State Univ., East Lansing. Dept. of Geology; and Michigan State Univ., East Lansing. Dept. of Computer Science.
For primary bibliographic entry see Field 02J.
W70-09697

INVENTORY OF HYDROBIOLOGICAL FEA-TURES USING AUTOMATICALLY PROCESSED MULTISPECTRAL DATA,
Geological Survey, Miami, Fla.; and Michigan Univ., Ann Arbor.
Milton C. Kolipinski, Aaron L. Higer, Norma S. Thomson, and Frederick J. Thomson.
Proceedings of 6th International Symposium on Remote Sensing of Environment, Oct 13-16, 1969, Michigan Univ, Institute of Science and Technology, p 79-95, 1970. 17 p, 5 fig, 3 tab, 4 ref.

Descriptors: *Remote sensing, *Aerial photography, *Florida, *National Parks, *Marshes, Surveys, Computers, Digital computers, Analog computers, Data processing, Data collections, Hydrologic data, Mapping, Vegetation, Spectroscopy, Photogrammetry.
Identifiers: Everglades National Park.

Multispectral data were used to map automatically eight different landscape site units in a portion of Everglades National Park in south Florida. By using various combinations of narrow spectral bands, it was possible to differentiate and map tree islands, sawgrass grasslands, spikerush grasslands, and two different depths of water. The recognition techniques that were developed employed both digital and analog computing equipment, but the emphasis was on fast processing using analog techniques. The output of the computer was in the form of recognition maps printed in several colors and then overlayed to provide a color composite map of the ground features. Data in this form, collected periodically, can be used to determine the direction and extent of successional changes of vegetation and should provide a better basis for water management practices. The multispectral scanning techniques employed in the Everglades have transfer value to other hydrologic situations. (Knapp-USGS)
W70-09835

DETECTION OF UPWARD PERCOLATION OF SALINE LAKE WATER,
Weizmann Inst. of Science, Rehovoth (Israel); and Water Planning for Israel, Tel Aviv. Hydrological Branch.
For primary bibliographic entry see Field 02H.
W70-09838

ISOTOPES IN HYDROLOGY.
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02A.
W70-09868

ISOTOPES IN HYDROMETEOROLOGY,
Stockholm Univ. (Sweden). International Meteorological Inst.
E. Eriksson.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Viennna, Paper No SM-83/2, p 21-33, 1967. 13 p, 7 fig, 13 ref.

Descriptors: *Tracers, *Radioisotopes, *Stable isotopes, *Hydrologic cycle, *Meteorology, Tracking techniques, Hydrogen, Deuterium, Tritium, Oxygen, Fallout, Hydrology, Groundwater movement, Surface waters.
Identifiers: Isotope techniques.

In recent years rather comprehensive studies have been made of the occurrence and distribution in time and space of tritium, deuterium and 0-18 precipitation and atmospheric moisture. Tritium has been injected into the atmosphere, especially during hydrogen bomb tests, in enormous quantities as compared with the natural production in the atmosphere. Because of its radioactivity it can be used as a tracer in the circulation of water in nature, and can, under special circumstances reveal features of the circulation which are otherwise not easily studied. Deuterium and 0-18 in natural waters are subject to fractionation processes during their transport between the earth's surface and the atmosphere. These processes are sometimes easily interpreted and can yield valuable information on particular parts of the water circulation. However, the fractionation processes are often complicated by subsequent mixing processes in the atmosphere, which makes interpretation more difficult. (See also W70-09868) (Knapp-USGS)
W70-09869

HYDROGEN ISOTOPES IN HYDROLOGICAL STUDIES IN ICELAND,
Iceland Univ., Reykjavik.
B. Arnason, and Th. Sigurgeirsson.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Goedesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM 83/3, p 35-47, 1967. 13 p, 6 fig, 10 ref.

Descriptors: *Tracers, *Deuterium, *Tritium, *Groundwater movement, *Hot springs, Surface waters, Precipitation (Atmospheric), Thermal water, Thermal springs, Sampling, Radiochemical analysis.
Identifiers: Iceland.

The deuterium content in monthly samples of precipitation at Reykjavik, Iceland, has been measured continously for the past 8 yr. The results show considerable fluctuations for individual months and a slight annual variation. Numerous water samples from cold springs in south-west Iceland show no time variation in deuterium content, whereas samples taken from streams in the same area show a small variation. Cold springs and rivers have similar deuterium content as the total yearly precipitation in their recharge area as judged from monthly samples. Because the time variations are small, these sources are very useful indicators of the mean deuterium content in the precipitation and its variation with geographical position. A map shows how the deuterium content varies with the distance from the sea and how the distribution is modified by the landscape. Samples of steam and liquid water from some boiling boreholes show that equilibrium is achieved between deuterium concentrations in the vapor and the water phase. This makes it possible to calculate the deuterium content of the recharge water for a hot spring from deuterium measurements of the water phase alone, if the base temperature of the recharge water is known. The thermal waters do not change in deuterium content during passage underground. (See also W70-09868) (Knapp-USGS)
W70-09870

APPLICATION OF RADIOTRACER METHODS IN STREAMFLOW MEASUREMENTS,
For primary bibliographic entry see Field 02E.
W70-09874

USE OF RADIOISOTOPES IN SEDIMENTOLOGY (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09875

RADIOISOTOPE TECHNIQUES FOR DETERMING SILT MOVEMENT FROM SPOIL GROUNDS IN THE FIRTH OF FORTH,
Atomic Energy Research Establishment, Wantage (England). Research Lab.
For primary bibliographic entry see Field 02J.
W70-09876

RADIOISOTOPE TECHNIQUES DEVELOPED IN WATER-POLLUTION STUDIES,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05A.
W70-09878

PERFORMANCE OF NUCLEAR-SEDIMENT CONCENTRATION GAUGES,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
J. R. McHenry, N. L. Coleman, J. C. Willis, C. E. Murphree, and G. C. Bolton.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No Sm-83/17, p 207-225, 1967. 19 p, 10 fig, 1 tab, 10 ref.

Descriptors: *Sediment load, *Suspended load, *Nuclear meters, Radioactivity techniques, Stream gages, Sediment transport, Instrumentation.
Identifiers: Nuclear sediment meters, Sediment concentration gages.

Three sediment concentration gages, utilizing the attenuation of transmitted gamma rays as a measure of density, were compared in laboratory tests. Two of the gages used Cd-109 as the radioactive source and one employed Am-241. The effects of each probe on stream velocity and sediment concentration gradients within the sampling area were considered. The precision and accuracy of the laboratory measurements were calculated and calibration curves were obtained under both static and dynamic conditions. A minimum detectable sediment concentration of less than 500 ppm was obtained with the Am-241 gage developed by the IAEA laboratories. The Cd-109 gage developed for remote, unattended, automatic operation was the least sensitive to small changes in sediment concentration. In their present state of development, these nuclear-sediment concentration gages supplement rather than compete in their use and performance. Each gage will provide the hydrologist with information not now obtainable by conventional means or will provide more information at a lower expenditure than is now possible. (See also W70-09868) (Knapp-USGS)
W70-09879

SURFACE LABELLING OF SAND WITH Cr-51 BY THERMAL DECOMPOSITION OF AMMONIUM DICHROMATE Cr-51,
Australian Atomic Energy Commission, Sutherland (Australia).
For primary bibliographic entry see Field 02J.
W70-09880

SURFACE DEPOSITION OF RADIOISOTOPES ON SAND AND SILTS (FRENCH),
Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
For primary bibliographic entry see Field 02J.
W70-09881

EROSION BY RAIN IN THE WESTERN CONGO (FRENCH),
Universite Lovanium de Kinshasa (Congo).
For primary bibliographic entry see Field 02J.
W70-09884

DATING OF GROUNDWATER WITH TRITIUM AND C14,
Heidelberg Univ. (West Germany). Physikalisches Institut.
For primary bibliographic entry see Field 02F.
W70-09885

MODEL EXPERIMENTS FOR C-14 WATER-AGE DETERMINATIONS,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 02F.
W70-09886

QUANTITATIVE ANALYSIS OF TOTAL CARBON DIOXIDE IN SEA WATER: A NEW EXTRACTION METHOD,
Scripps Institution of Oceanography, La Jolla, Calif.
C. S. Wong.
Deep-Sea Research, Vol 17, p 9-17, 1970. 2 fig, 11 ref.

Descriptors: *Analytical techniques, *Carbon dioxide, *Sea water, *Methodology, Infrared radiation, Sampling, Laboratory tests, Pacific Ocean, Tropic, Depth, Analysis, Calibration, Gravimetric analysis.
Identifiers: Vacuum extraction, Infrared analysis, Extraction procedure, Sodium carbonate.

Total carbon dioxide is defined as the sum of carbon dioxide concentration and all other carbon species in solution, which react with dilute acid to form carbon dioxide. Concentration of total carbon dioxide in seawater has been determined to a precision of plus or minus 0.15% standard deviation and an accuracy of about plus or minus 0.2% by a new method employing vacuum extraction and infrared analysis. This precision and estimated accuracy were achieved through accurate sampling of aliquots by a special pipette, elimination of reagent blanks, purification of carbon extracted and improvements in preparation of a gravimetric standard for calibration of the infrared analyzer. Comparison of extractions made on shipboard and extractions made subsequently in shore laboratory on preserved samples show that ocean water sterilized with 100 ppm of mercuric chloride does not change its total carbon dioxide during storage in stoppered Pyrex bottles at room temperature for a period up to 3 months. The extraction was used to obtain pure carbon dioxide for carbon-13 isotopic studies and for rain and ice. The gravimetric standard has provided for rapid calibration of infrared analyzer or for other methods such as those employing gas chromatography. (Jones-Wisconsin)
W70-09892

A SIMPLE, INEXPENSIVE ALGAL CHEMOSTAT,
North Carolina State Univ., Raleigh. Dept. of Zoology.
Edward J. Carpenter.
Limnology and Oceanography, Vol 13, No 4, p 720-721, 1968. 1 fig, 2 ref.

Descriptors: *Analytical techniques, *Algae, Plankton, Diatoms, Marine algae, Fresh water, Flow rates, Pumps, Electrolysis, Cultures.
Identifiers: *Chemostat, Physiology, Flagellates.

A simple chemostat has been developed which does not use expensive mechanical action pumps or elaborate gravity flow systems. In addition, the entire apparatus can be easily sterilized as a unit if the rubber stoppers in the chemostat are left ajar during autoclaving. An electrolysis pump generates a gas mixture which displaces the culture medium in the medium reservoir into the algae culture vessel. The flow rate of the culture medium is regulated by a variable resistor in the circuit and indirectly monitored with a milliammeter. Mixing and aeration of algae and medium is accomplished by pumping sterile, cotton-filtered air through the culture vessel. An overflow vessel effectively prevents back contamination of the culture vessel by bacteria as a suspension of the organisms under culture continually flows out. The volume of medium within the culture vessel is regulated through siphon action by adjusting the height of the overflow tube. This chemostat has been used successfully in several nutrient limited, axenic experiments on two planktonic marine diatoms and one freshwater flagellate. (Jones-Wisconsin)
W70-09904

7C. Evaluation, Processing and Publication

SCALE EFFECTS IN THE PHYSICAL MODELING OF SURFACE RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W70-09538

DERIVING THE UNITGRAPH WITHOUT USING RAINFALL DATA,
Monash Univ., Clayton (Australia). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 02E.
W70-09680

ANALYSIS OF DATA FROM PUMPING TESTS IN UNCONFINED ANISOTROPIC AQUIFERS,
For primary bibliographic entry see Field 02F.
W70-09681

A LINEAR DISTRIBUTED MODEL OF CATCHMENT RUNOFF,
Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.
For primary bibliographic entry see Field 02A.
W70-09831

INVENTORY OF HYDROBIOLOGICAL FEATURES USING AUTOMATICALLY PROCESSED MULTISPECTRAL DATA,
Geological Survey, Miami, Fla.; and Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 07B.
W70-09835

MARKOV CHAINS AND EMBEDDED MARKOV CHAINS IN GEOLOGY,
Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
For primary bibliographic entry see Field 06A.
W70-09848

APPLICATION OF NUMERICAL CALCULATIONS TO THE STUDY OF WAVES AND SHORE INTERACTIONS (FRENCH),
Laboratoire National d'Hydraulique, Chatou (France).
For primary bibliographic entry see Field 02L.
W70-09854

08. ENGINEERING WORKS

8A. Structures

URBAN STORM DRAINAGE CRITERIA MANUAL FROM DENVER,
Wright-McLaughlin Engineers, Denver, Colo.

lmer L. Claycomb.
ivil Engineering, Vol 40, No 7, p 39-41, July 970. 3 p, 1 fig, 2 tab.

escriptors: *Storm drains, *Design, *Drainage stems, Cities, Urbanization, Sewers, Storm runoff, Rational formula, Hydrograph analysis, Rainll-runoff relationships.
entifiers: *Denver (Colo), *Storm drain design anual.

storm drainage criteria manual developed by the enver Regional Council of Governments to prode uniform guidelines and technical design inforation for those involved with storm water ainage is reviewed. The overall approach taken is sed on two separate drainage systems: the initial, convenience, system for regularly occuring flows eturn frequency of once in 2 to 10 years), and the ajor system for relatively infrequent flows. The sign of streets receives extensive coverage, with owable drainage capacity related to traffic lume. Storm sewer design is based entirely on draulics, replacing rule-of-thumb procedures for ad loss at manholes. Hydrological design is based a modified rational method, in which the sumation of flows is used for areas under 200 acres, d on a hydrograph analysis for larger areas. (See so W70-03148 thru W70-03152) (Knapp-USGS) 70-09534

ITIZENS COMM FOR HUDSON VALLEY V OLPE (AUTHORITY TO ISSUE PERMITS OR CAUSEWAY CONSTRUCTION).
or primary bibliographic entry see Field 06E. 70-09600

HE IMPACT OF THE DEEP TUNNEL PLAN N THE WATER RESOURCES OF ORTHEAST ILLINOIS.
arza Engineering Co., Chicago, Ill.; and Bauer ngineering, Inc., Chicago, Ill.
or primary bibliographic entry see Field 05G. 70-09798

OLLUTION AND FLOOD CONTROL, A PRORAM FOR CHICAGOLAND.
arza Engineering Co., Chicago, Ill.; and Bauer ngineering, Inc., Chicago, Ill.
or primary bibliographic entry see Field 05G. 70-09799

TORM WATER POLLUTION, NEW ORLENS, LOUISIANA.
ew Orleans Sewerage and Water Board, La.
or primary bibliographic entry see Field 05B. 70-09801

TORM WATER POLLUTION, NEW ORLENS, LOUISIANA.
ew Orleans Sewerage and Water Board, La.
or primary bibliographic entry see Field 05B. 70-09802

EGISTER OF SELECTIVE WITHDRAWAL ORKS IN UNITED STATES.
nerican Society of Civil Engineers.

SCE Proceedings, Journal of the Hydraulics Divion, Vol 96, No HY9, Paper 7533, p 1841-1872, ptember 1970. 32 p, 3 fig, 2 tab, 4 ref, append.

escriptors: *Dams, *Reservoir design, Water ality control, *Outlet works, *Reservoir operaons, Drawdown, Reservoirs, Water management pplied).
entifiers: Selective withdrawal works.

bular data are presented on a number of dam ojects in the United States which have provision r selective withdrawal of water from predeterned elevations in a reservoir. The register classis outlet types, provides information on design nges, and identifies agencies from whom more specific information might be obtained on projects which may be in operation, under construction, or in the design stage. (Knapp-USGS)
W70-09841

THE EFFECTS OF WATER-SHOCK WAVES ON A HYDRAULIC STRUCTURE,
California State Coll., Los Angeles.
Young C. Kim.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 2-Seminar Communications), Paper S1, p 174-177, 1967. 4 p.

Descriptors: *Explosions, *Seismic waves, *Underwater, *Hydraulic structures, *Model studies, On-site tests, Dams, Engineering.
Identifiers: *Shock waves, Underwater explosions.

The transient response of a rigid concrete structure to water shock waves was investigated. A theoretical solution of the transmitted underwater shock waves impinging on a concrete structure was obtained by treating it as an entirely Laplace-transformed problem. The effect of the transmitted shock waves on plaster and concrete models was also studied experimentally. Underwater shock waves were created by using a submerged exploding wire in a contained environment. Test results confirmed a theoretical analysis of shock wave propagation in a submerged hydraulic structure. (Knapp-USGS)
W70-09855

STUDY OF PIPE WITH CONCRETE BEDDING--PART II,
American Pipe and Construction Co., Monterey Park, Calif.
Harvey C. Olander, and Gordon G. Robertson.
Proceedings of the American Society of Civil Engineers, Transportation Engineering Journal, Vol 96, No TE1, p 25-44, Feb 1970. 20 p, 11 fig, 7 tab, 2 ref, 3 append.

Descriptors: Design, Concrete construction, Loads (Forces), Geometric shapes, *Pipelines, *Pipes, Stress, *Structural analysis, *Coefficients, *Bedding materials, Concrete pipes, Concrete structures, Earth pressure, Dead loads, *Stress analysis, Internal forces, Hydrostatic pressure.
Identifiers: Buried structures, Concrete blocks, Encasement, Pipe cradles.

Part II of a 2-part study of pipe with concrete bedding is presented. Part I covered the basic case, consisting of a structure with a semicircular top of uniform thickness and a base extending upward to the horizontal centerline with vertical sides and a horizontal bottom. A calculation of stresses throughout the base for the case of 180 deg beding demonstrated that the pipe and bedding act together as a monolithic structure. The previous study is extended to the case of beddings less than 180 deg (sometimes referred to as concrete cradles) and to full rectangular encasements. In both cases, the solution is built on the basic case, and tables prepared previously to simplify the calculations may be used. After developing necessary equations, a sample calculation is presented for a 12-ft-dia noncylinder, prestressed concrete pipe with 120 deg concrete bedding. Using the same technique as in the previous study, stresses throughout the base are determined. Consideration of these stresses demonstrates, as before, that under load there is no tendency for separation of pipe and bedding. This is confirmed by a photoelastic stress analysis of the junction between pipe and bedding. (USBR)
W70-09917

DESIGN OF CYLINDRICAL CONCRETE WATER TANKS,
Harvey C. Olander.
Proceedings of the American Society of Civil Engineers, Journal of Structural Division, Vol 96, No ST5, p 947-973, May 1970. 27 p, 25 fig, 14 ref, 2 append.

Descriptors: Beams (Structural), Cylindrical bodies, Deflection, *Wind pressure, Earthquakes, *Foundations, Structural engineering, Reinforced concrete, Temperature, *Water tanks, Winds, *Hydrostatic pressure, Circumferential stress, Bending moments, Footings, *Concrete structures, Shear, Stress.
Identifiers: Earthquake loads, Elastic foundations.

A comprehensive procedure is presented for design of cylindrical concrete water tanks based on the theory of beams on elastic foundations. Temperature stresses are given careful consideration, including variation of temperature through the tank wall. Analysis shows considerable variation of temperature stresses over the tank. Hydrostatic and earthquake forces are also covered. Wind stresses relating to tanks with varying height-to-diameter ratios are analyzed and design procedures are given. Charts covering temperature stresses and varying types of end restraints to tank walls are provided to facilitate solutions by desk calculator. Sample design calculations for a storage tank on spread footing are included. (USBR)
W70-09918

8B. Hydraulics

WATER TEMPERATURE CONTROL WEIR FOR MERAMEC PARK DAM, MERAMEC RIVER, MISSOURI,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 05D.
W70-09602

ENTRAINMENT IN DEFLECTED AXISYMMETRIC JETS AT VARIOUS ANGLES TO THE STREAM,
Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 05B.
W70-09603

ON THE THEORY OF LONGITUDINAL DISPERSION,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 02E.
W70-09734

ANALYTIC PREDICTION OF LONGITUDINAL DISPERSION COEFFICIENTS IN NATURAL STREAMS,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09735

TRACER STUDIES ON TURBULENT DIFFUSION AND DISPERSION,
Chalmers Univ. of Technology, Goteborg (Sweden).
Klas Cederwall.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D3, p 20-32, 1967. 13 p, 11 fig, 3 tab, 2 ref.

Descriptors: *Diffusion, *Dispersion, *Turbulent flow, *Tracers, *Tracking techniques, Dye releases, Closed conduit flow, Open channel flow, Mixing, Mass transfer, Heat transfer, Pipe flow.
Identifiers: Turbulent mixing.

Instantaneous injection of tracer material is an important method for studying turbulent diffusion. The procedure has to be developed and the tracer has to be chosen to suit the particular diffusion

case. Diffusive properties of turbulent flow may be studied by swift point-injections of tracer material. G. I. Taylor's fundamental theory for turbulent diffusion can be adapted to plane injection in a pipe flow. Laboratory investigations show that point injections in the center of the pipe are equivalent to plane injections if the section of injection is displaced virtually in the flow direction. The influence of concentrated losses (constrictions) in the pipe on the turbulent diffusion is transferred to virtual displacements of the point of injection, in the opposite flow direction. The distribution of residence time in a continuous flow system was studied with the same tracer method. An investigation on the hydraulic efficiency of a spiral mixing chamber utilized in water plants for adding chemicals to raw water was based on the concepts of complete mixing and short circuit flow. (Knapp-USGS)
W70-09736

ABOUT TURBULENT DIFFUSION OF SUSPENDED PARTICLES IN FLUID FLOW,
For primary bibliographic entry see Field 02J.
W70-09737

DIFFUSION OF WARM WATER JETS DISCHARGED HORIZONTALLY AT THE WATER SURFACE,
Chuo Univ., Tokyo (Japan). Hydraulic Lab.
For primary bibliographic entry see Field 02E.
W70-09738

TURBULENT DIFFUSION OF THE VERTICALLY UPWARD JET,
Osaka Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-09739

LINEAR-MOMENTUM FLUX TO OVERBANK SECTIONS,
Geological Survey, Atlanta, Ga.; and Georgia Inst. of Tech., Atlanta.
Robert R. Wright, and Marion R. Carstens.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY9, Paper 7517, p 1781-1793, September 1970. 13 p, 10 fig, 2 tab, 2 append.

Descriptors: *Open channel flow, *Floods, *Overflow, *Hydraulic models, Shear stress, Floodways, Hydraulics, Rivers, Streamflow, Routing, Shear drag.
Identifiers: Linear-momentum flux.

On the basis of experiments in two joined rectangular channels, transfer of linear momentum from the major (less restricted) channel to the minor (more restricted) channel has been demonstrated. The apparent-shear stress on the junction surface was found to be of the same order of magnitude as the boundary-shear stress in the major channel. Based upon this observation, a method for engineering calculations for mean-flow characteristics in joined channels such as a river at flood stage is proposed. The steps in the proposed separate-channel method of analysis are: (1) Considering the major-channel boundary including the junction plane as a solid boundary, compute the mean boundary-shear stress on the major-channel boundary; (2) compute the apparent-shear force on the junction surface using the mean boundary-shear stress of the major channel; and (3) incorporate the apparent-shear force on the junction surface as a propulsive force on the minor-channel flow. (Knapp-USGS)
W70-09837

POWER LAW SOLUTIONS FOR VERTICAL PLUMES,
California Univ., Irvine. Dept. of Civil Engineering.
Richard R. Brock.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY9, Paper 7523, p 1803-1817, September 1970. 15 p, 3 fig, 7 ref, 2 append.

Descriptors: *Diffusion, *Jets, *Mixing, *Turbulent flow, *Convection, Vortices, Turbulence, Hydraulics, Mathematical studies, Mathematical models.
Identifiers: Vertical plumes.

This paper investigates solutions to the problem of a vertically rising turbulent plume generated when a source of light fluid is introduced into a heavier ambient fluid of large extent. The particular solutions considered are those in which the plume width, maximum velocity, and maximum density deficiency can be expressed as a simple power of the vertical distance. It is found that this type of solution exists not only for the well-known cases of point and line sources in a uniform ambient fluid, but also for certain cases of: (1) A finite area source in a uniform ambient fluid; and (2) a point, line or finite area source in a stably and unstably stratified fluid. (Knapp-USGS)
W70-09840

DIFFUSION OF SUBMERGED SLUICE GATE FLOW OVER A DROP,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
N. Rajaratnam, and K. Subramanya.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D17, p 156-163, 1967. 8 p, 3 fig, 2 tab, 10 ref.

Descriptors: *Diffusion, *Jets, *Turbulence, *Sluice gates, *Supercritical flow, Model studies, Flumes, Transition flow, Open channel flow, Hydraulic models, Laboratory tests.
Identifiers: Wall jets.

An experimental study was made of the diffusion of a supercritical stream emerging under a submerged sluice gate situated over an abrupt drop. The length of the eddying region, the characteristics of the velocity profile and bed shear stress after reattachment were studied. After a certain distance downstream of the reattachment line, the supercritical stream could be treated as a reattached plane turbulent wall-jet which behaves very much like the corresponding classical wall-jet. The variation of the bed shear stress is expressed in the form of a dimensionless similarity plot. (Knapp-USGS)
W70-09856

AN ANALYSIS OF SALINITY DISTRIBUTION IN THE STRAITS OF MARACAIBO,
Massachusetts Inst. of Tech., Cambridge, Hydrodynamics Lab.; National Inst. of Canalizations, Caracas (Venezuela); and State Univ. of New York, Buffalo. Dept. of Civil Engineering.
Donald R. F. Harleman, Luis F. Corona-Chuecos, and Emmanuel Partheniades.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D18, p 164-173, 1967. 10 p, 7 fig, 5 ref.

Descriptors: *Saline water intrusion, *Inlets (Waterways), *Mathematical models, *Tidal effects, Currents (Water), Water circulation, Model studies, Tides, Dispersion, Turbulent flow, Open channel flow.
Identifiers: Straits of Maracaibo, Venezuela.

Measurements of salinity distributions were made in the Straits of Maracaibo as part of a general investigation of shoaling problems in the navigation channel. The field data on longitudinal salinity distribution were analyzed by a one-dimensional mathematical model based on turbulent dispersion theory. The salinity distribution at low water slack was compared with the mathematical model and two independent parameters which characterize the longitudinal salinity distribution were determined. These parameters are the longitudinal dispersion coefficient, and a characteristic horizontal length which is of the order of magnitude of the tidal excursion. Laboratory studies show that a correlation exists between a dimensionless form of these two parameters and a dimensionless estuary number. The estuary number depends on the tidal prism, the magnitude of the tidal current, the mean depth, the fresh water discharge and the tidal period. The salinity data for the Straits of Maracaibo conform to the expected correlation. Changes in the salinity distribution due to possible modifications of the channel are discussed. (Knapp-USGS)
W70-09857

MATHEMATICAL MODELING OF DISPERSION IN RIVERS,
Vanderbilt Univ., Nashville, Tenn. School of Engineering.
For primary bibliographic entry see Field 02E.
W70-09858

MEASUREMENTS OF THE INFLUENCE OF SUSPENDED PARTICLES ON THE SIZE OF VORTICES,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau und Erdbau.
Andreas Muller.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D12, p 107-114, 1967. 8 p, 12 fig, 3 ref.

Descriptors: *Pipe flow, *Vortices, *Sediment transport, *Particle size, Turbulent flow, Turbulence, Velocity, Open channel flow, Roughness (Hydraulic), Channel flow, Suspension, Suspended load, Fluid friction.
Identifiers: Vortex size.

The influence of particles on vortex size was studied in rough pipes. The autocorrelation of the velocity fluctuations was considered a measure of the size of the vortices. With this method a tendency for the vortex diameter to increase with increasing concentration of the particles can be shown. This effect can be predicted, using a single vortex model, deducing a faster diffusion of the single vortex. (Knapp-USGS)
W70-09862

EXPERIMENTAL RESULTS OF DYE DIFFUSION IN LARGE PIPELINES,
Oregon State Univ., Corvallis. Dept. of Civil Engineering; and Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
R. W. Filmer, and Vujica Yevjevich.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D13, p 115-123, 1967. 9 p, 2 fig, 1 tab.

Descriptors: *Diffusion, *Tracers, *Dye releases, *Pipe flow, *Closed conduit flow, Tracking techniques, Fluorescence, Sampling, Monitoring, Dispersion, Hydraulic models, Hydraulics, Laboratory tests, Reynolds number, Turbulent flow.
Identifiers: Rhodamine.

A study was made of the lateral diffusion resulting from continuous point-source injection of soluble tracers into a 36-inch pipeline at high Reynolds numbers. The tracer, the fluorescent dye Rhodamine WT, was injected at various points along a vertical diameter and at various positions along the length of the pipe. By varying the mixing distance and the flow rate, dye concentration was obtained at various cross-sections for Reynolds numbers up to 1.8 million. The experiments were conducted in a 36-inch 825-foot long pipeline. Injection at a constant rate was obtained by use of a

positive displacement chemical proportioning pump, and downstream concentrations were determined continuously with a flow-through fluorometer. Concentration of the diffused material was obtained for as many as 84 different positions in the cross-section under each given set of hydraulic conditions for mixing distances between 27 and 84 diameters and flow rates up to 62 cfs. (Knapp-USGS)
W70-09863

RADIAL DIFFUSION IN TURBULENT PIPE FLOW,
Illinois Univ., Urbana. Dept. of Civil Engineering; and Bureau of Reclamation, Denver, Colo.
Edward R. Holley, and Jack C. Schuster.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D14, p 124-136, 1967. 13 p, 4 fig, 1 tab, 16 ref.

Descriptors: *Diffusion, *Pipe flow, *Turbulent flow, Tracers, Viscosity, Closed conduit flow, Dispersion, Laboratory tests, Turbulence, Diffusivity, Hydraulics.
Identifiers: Radial diffusion.

Some of the parameters that affect radial diffusion are discussed. The analogy between the radial diffusion coefficient and the eddy viscosity is used to obtain an equation for calculating the diffusion coefficient K. Analytical concentration distributions are presented for steady state diffusion from a source on the centerline of the pipe. The analytical distributions were used to calculate empirical K-values. Forty K-values from various sources are presented. These data show that the amount of lateral spread of the diffusing substance in the pipe has a significant effect on the value of K and that the analogy of diffusion with the eddy viscosity is a fair approximation for K when the diffusing substance fills the pipe cross section. An equation is derived for estimating the distance L required for complete mixing in uniform pipe flow. (Knapp-USGS)
W70-09864

TURBULENT DIFFUSION IN THE HYDRAULIC JUMP,
Technische Hochschule, Karlsruhe (West Germany).
For primary bibliographic entry see Field 02E.
W70-09865

STOCHASTIC SIMULATION OF THE DIFFUSION OF JETS,
Carnegie Inst. of Tech., Pittsburgh, Pa.
Carlos Quevedo, and George Bugliarello.
French resume. Proceedings 12th Congress of the International Association for Hydraulic Research, Sept 11-14, 1967, Colorado State Univ, Fort Collins, Vol 4 (Pt 1-Microturbulent Diffusion and Dispersion), Paper D16, p 146-155, 1967. 10 p, 8 fig, 8 ref.

Descriptors: *Diffusion, *Jets, *Turbulent flow, Stochastic processes, *Simulation analysis, Mathematical models, Statistical models, Probability, Laminar flow, Hydraulics, Hydrodynamics, Path of pollutants, Dispersion, Open channel flow.
Identifiers: Jet dispersion.

A stochastic simulation technique was applied to the determination of the velocity field of incompressible jets issuing from a two-dimensional orifice. The diffusion of momentum leading to the formation of the velocity profiles of the jets was achieved by a succession of steps, during each one of which a number of particles were generated at the nodes of a fixed reference grid, and subsequently diffused at random in the direction normal to that of the main flow. Both the laminar and turbulent case were simulated by this technique. The turbulent flow study was based on a phenomenological description of the turbulent field. The results reproduce the basic features of the phenomena, but with the present very simple model, quantitative agreement with experimental and analytical data is not yet fully satisfactory. Refinements of the model to achieve a closer agreement are discussed. The simulation poses no limitations as to the initial scope of the velocity profiles issuing from the orifice or to extension to three-dimensional cases. (Knapp-USGS)
W70-09866

CLOSED CONDUIT TO OPEN CHANNEL STILLING BASIN,
Utah State Univ., Logan; and Colorado State Uinv., Fort Collins.
Gordon H. Falmmer, V. Skogerboe Gaylord, and Wei Chi-Yuan.
Proceedings of the American Society of Civil Engineers, Journal of Irrigation Drainage Division, Vol 96, No IR1, p 1-10, Mar 1970. 10 p, 6 fig, 9 ref, 2 append.

Descriptors: *Closed conduit flow, Closed conduits, Design, Tailwater, *Energy dissipation, Hydraulic models, Hydraulic jump, Hydraulics, *Open channel flow, *Stilling basins, Hydraulic structures, Experimental data, *Model studies, Froude number, Laboratory tests, Diffusion, Submergence, Hydraulic design, Design criteria.
Identifiers: *Energy dissipators, Transition, Experimental models.

Criteria have been developed for designing a stilling basin to serve as a transition from closed conduit flow to open channel flow for a fully submerged pipe outlet. The unique feature of the stilling basin is the short-pipe energy dissipator located and designed to provide maximum energy dissipation for the basin configuration. The expanding characteristics of a submerged jet were used in establishing the length of the stilling basin. The unsteadiness of the water surface and the relative boil height in the model basin were used as criteria for evaluation the effectiveness of the structure for energy dissipation. Relationships among the tailwater depth, outlet flume floor elevation, height of boils in the stilling basin, width of the stilling basin, and amount of freeboard have been studied. Interrelationships among these variables are shown graphically. (USBR)
W70-09914

NON-DIMENSIONAL PROFILE AREA COEFFICIENTS FOR HYDRAULIC JUMP IN SLOPING RECTANGULAR CHANNELS,
Surrey Univ., London (England).
J. W. Wielogorski, and E. H. Wilson.
Water Power, Vol 22, No 4, p 144-150, Apr 1970. 7 p, 13 fig, 2 tab, 11 ref.

Descriptors: *Hydraulic jump, Channels, Profiles, Slopes, Hydraulics, Forecasting, Open channels, Froude number, *Coefficients, Open channel flow, Beds.
Identifiers: *Retangular channels.

The hydraulic jump in a horizontal rectangular channel can be represented by a unique generalized nondimensional profile. The jump in a sloping channel was analyzed and its weight accounted for by using nondimensional profile area coefficients. The coefficients may be related to the generalized profile and the relationship justified by results from laboratory tests using photographic methods. An equation was derived to relate the ratio of depths across a jump on a sloping channel bed to the Froude number. The equation is in the Belanger form, containing profile area coefficients accounting for the jump body weight. The nondimensional generalized profile introduced by Rajaratnam and Subramanya was extended to the sloping channel bed case, and a relationship between the area coefficients and the generalized profile was derived. The analysis and investigation provide data to assist in predicting profile characteristics of the hydraulic jump on a sloping channel bed. (USBR)
W70-09916

REGIME THEORY DESIGN OF CANALS WITH SAND BEDS,
Alberta Univ., Edmonton.
Thomas Blench.
Proceedings of the American Society of Civil Engineers, Journal of the Irrigation Drainage Division, Vol 96, No IR2, p 205-213, June 1970. 9 p, 1 fig, 2 tab, 7 ref, 3 append.

Descriptors: *Regime theory, Canals, *Canal design, *Sands, *Dunes, *Beds, *Dune sands, Open channels, Open channel flow, Tractive forces, Sediment transport, Sedimentation, Froude number, Hydraulics.
Identifiers: *Erodible-bed channels, Bed forms, Bedload movement, Bed movements, Bed ripples, Laceys constants.

Recent regime theory design equations for duned sand-bed canals are outlined and limits of applicability indicated. A simple problem is compared with original Lacey equations. Reference to worked problems and extensions is given. Advantages of the method include: (1) equations derived from data of self-adjusting channels of the type and size for which design is required; (2) provision of the 3 necessary and sufficient independent equations for finding equilibrium values of flow area, depth, and slope; (3) consolidation of the unmeasurables of the water-sediment complex and of the cohesive erodible-depositable sides into 2 overall bed and side factors that can be calculated from the running conditions of existing channels in equilibrium; and (4) simplicity. (USBR)
W70-09929

8C. Hydraulic Machinery

THERMAL EFFECTS STUDIES IN NEW YORK STATE,
Stoller (S. M.) Associates, New York; and Niagara Mohawk Power Corp., Buffalo, N.Y.
For primary bibliographic entry see Field 05C.
W70-09614

HOW SAFE ARE YOUR TOWERS,
Sargent and Lundy, Chicago, Ill.
Joseph R. Arena.
Proceedings of the American Society of Civil Engineers, Journal of the Structural Division, Vol 96, No ST1, p 1-16, Jan 1970. 16 p, 13 fig, 4 tab, 8 ref, append.

Descriptors: *Transmission towers, Transmission lines, Construction, Foundations, Inspection, Wind pressure, *Loads (Forces), Towers, Winds, Safety, Safety factors, Design, Vertical loads, Tornadoes, Fabrication, Structural engineering.
Identifiers: Tower failures, Transverse loads, Auger-type footings.

The need for a new look in transmission line design because of new and higher voltages being used is described. Vertical, transverse, and longitudinal loads and their effects are considered, with emphasis on a correct assignment of the wind load. Tower design is described together with the importance of considering the costs of material, fabrication, transportation, erection, foundation, and maintenance. Foundations and soil borings are noted, and illustrations of the method of constructing the augered concrete caisson-type foundation are given. Fabrication of the steel tower and relation to the tower design are given. Construction and inspection and their relation to the successful fulfillment of a good design and line performance are covered. (USBR)
W70-09911

HYDROELECTRIC POWER IN SIBERIA,
Michael Dankewych.
Military Engineer, Vol 62, No 407, p 184-187, May-June 1970. 4 p, 1 map.

Descriptors: *River basin development, Natural resources, Reservoirs, Electric power production, *Hydroelectric plants, *Hydroelectric power, His-

tory, Reviews, Statistics, River regulation, Dams, Foreign projects, Foreign construction, Industries, Navigation, Multiple-purpose projects, Nuclear powerplants.
Identifiers: *Hydroelectric resources, Installed capacity, *Siberia, Navigation locks, USSR, Surveys (Data collection).

Hydroelectric power development in Siberia is very important to the USSR and of great interest to the rest of the world. Existing hydroelectric developments, those under construction, and the planned potential projects located along the Ob', Irtysh, Enisei, Angara, Lena, and Amur Rivers are discussed. Two atomic plants, the Beloyarsk recently energized, and the Bilibino under construction above the Arctic Circle, are reported. Plant capacities, reservoir storage capacities, surface areas, and drainage basin areas are given. (USBR)
W70-09919

AN ACCELERATION RELAY FOR POWER SYSTEMS,
Bureau of Reclamation, Denver, Colo.
W. R. Roemish, C. L. Clemans, and L. W. Lloyd.
Translation, Paper 70 TP 570-PWR, Institute of Electrical and Electronics Engineers, Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 5 p, 7 fig, 5 ref.

Descriptors: *Electric relays, Frequency, *Frequency shifts, Field tests, *Disturbances, Electronic equipment, Power system operations, Research and development, Sensors, Control, Transducers, Electric potential, Characteristics, Sensitivity.
Identifiers: Power system stability, *Acceleration (Mechanical), Load control, *Solid state devices, Thyristors, Line dropping.

A solid-state acceleration relay developed by the Bureau of Reclamation for data acquisition is a sensitive device capable of measuring the rate of change of frequency at a given location on a power system. The relay has a potential also for use in generator dropping and load shedding schemes. A pilot model of the relay has been installed at the Palisades Powerplant in Idaho to assist in collecting system performance parameters. Data acquired during a major system distrubance demonstrate the potential value of the acceleration relay for sensing behavior and for improving power system reliability. Relay construction, operating experience, and future applications of the device are discussed. (USBR)
W70-09923

ALINEMENT AND MODELING OF HANFORD EXCITATION CONTROL FOR SYSTEM DAMPING,
Bonneville Power Administration, Portland, Oreg; and Bureau of Reclamation, Denver, Colo.
Edward J. Warchol, William B. Gish, and Ferber R. Schleif.
Translation, Paper 70 TP 562-PWR, Institute of Electrical and Electronics Engineers, Summer Power Meet and EHV Conf, Los Angeles, Calif, July 1970. 10 p, 13 fig, 2 ref.

Descriptors: *Excitation, *Voltage regulators, Nuclear powerplants, *Power system operations, Field tests, Extra high voltage, *Damping, *Control, Frequency, Electric generators, Computer models, Transmission (Electrical), Evaluation.
Identifiers: *Hanford Steam Plant (Wash), *Turbogenerators, Test results, Frequency response, *Power system stability.

The 2 Hanford generators at 430 mw each are presently the largest generating units in the northwest, and their inertias, reactances, and time constants are unusually large. The influence of system damping by voltage regulators is of great interest to electric power system operators. Alinement of speed excitation supplementary control for each of the 2 Hanford nuclear steam turbine-generator units was readily accomplished through field testing. Off-line frequency response tests of the supplementary control units, voltage regulators and exciters, and frequency and step response tests of the excitation systems provided data for developing a dynamic simulation model of the Hanford units. On-line tests with the generators loaded can be made with local forcing signals barely observable and detectable with sensitive instrumentation. Evaluation of results indicate positive damping of the Hanford units. (USBR)
W70-09924

DESIGN OF EHV SUBSTATIONS FOR PEACE RIVER,
British Columbia Hydro and Power Authority, Vancouver.
G. A. Ganason.
Electrical Review, Vol 186, No 7, p 245-251, Feb 1970. 7 p, 10 fig, 1 tab.

Descriptors: *Extra high voltage, *Extra long distance, Microwaves, *Transmission lines, Transmission (Electrical), *Electrical equipment, *Substations (Electrical), Lightning arresters, Bus (Electrical), Power transformers, Electric relays, Circuit breakers, Foreign construction, Electric insulation, Electrical insulators, Condensers.
Identifiers: *Peace River Proj, Can, Current transformers, Series capacitors, Northwest Power Pool, Canada.

Economy and reliability were the main aims in designing switching stations for the 500-kv Peace River transmission system in British Columbia. Power is transmitted from the Gordon M Shrum Powerplant via the Portage Mountain Substation, a distance of 600 mi over 2 single-circuit 500-kv a-c lines in the initial stage and 4 single-circuit lines in the final stage. The 500-kv switching stations at Williston and Kelly Lake divide the lines into 200-mi sections. The Ingledow 500-kv terminal substation near Vancouver forms the load center for the Vancouver area and a load transfer point to the Bonneville power system, connecting into the Northwest Power Pool of the U.S. Schematics for the substations are shown, and major electrical equipment is described. System insulation coordination and protective equipment are discussed. (USBR)
W70-09932

HOLYOKE WATER POWER CO V AMERICAN WRITING PAPER CO (CONTRACT PROHIBITING POWER TRANSMISSION FROM LAND GRANTED).
For primary bibliographic entry see Field 06E.
W70-10022

8D. Soil Mechanics

CHEMICAL GROUTING FOR PARIS RAPID TRANSIT TUNNELS,
Soletanche S A, Paris (France).
For primary bibliographic entry see Field 08G.
W70-09921

TUNNEL SURVEY,
D. G. McBeth.
Tunnels and Tunnelling, Vol 1, No 4, Vol 2, No 1, p 179-182, 23-28, Nov-Dec 1969, Jan-Feb 1970. 9 p, 22 fig, 15 ref.

Descriptors: *Surveying, *Surveying instruments, Survey stations, *Tunnels, Tunnel construction, Control, History, *Methodology, Laser, Theodolites, Measurement, Measuring instruments, Electronic equipment, Bibliographies, Foreign construction.
Identifiers: Construction control, Accuracy, Computer applications, Great Britain.

Past, present, and future tunnel survey techniques discussed include: (1) historical aspects of tunnel surveying, (2) accuracy, (3) surface control survey, (4) transference of surface control underground, (5) UNDERGROUND CONTROL SURVEY, (6) tunnel face control while driving, (7) special problems of submerged tube tunnels, (8) microptic theodolites, (9) electronic distance measurement, (10) the precision indicator of the meridian (P.I.M.), (11) lasers, and (12) computation by electronic computer. The golden rule is laying out a survey scheme is to have as few observations of angle or length as is practicable. The only practical means of transferring bearings down vertical shafts is by the wire survey technique. Use of open traverse techniques is the only practical method of extending a survey behind the working face in a tunnel. Because an open traverse is a weak form of control, at least 2 surveys are made. Control of a tunnel face while driving entails tight checks of line, level, and shape of the tunnel and square, plumb, and roll of tunneling shields. By taking full advantage of modern instruments and techniques, an automated system of tunnel control is predicted. (USBR)
W70-09925

BENTONITE SEALING METHODS COMPARED IN THE FIELD,
Bureau of Land Management, Prineville, Oreg; and Agricultural Research Service, Reno, Nev.
For primary bibliographic entry see Field 04A.
W70-09928

8E. Rock Mechanics and Geology

AN INVESTIGATION OF THE DASHT-E BAYAZ, IRAN EARTHQUAKE OF AUGUST 31, 1968,
Coast and Geodetic Survey, Rockville, Md.; and Illinois Inst. of Tech., Chicago. Dept. of Mechanical Engineering.
Kenneth C. Bayer, Lorne E. Heuckroth, and Rajab A. Karim.
Bulletin of the Seismological Society of America, Vol 59, No 5, p 1793-1822, October 1969. 30 p, 18 fig, 3 tab, 9 ref.

Descriptors: *Earthquakes, *Disasters, *Seismic studies, On-site data collections, Faults (Geology), Geologic control, Bedrock, Alluvium, Water table, Earthquake engineering, Water wells.
Identifiers: *Iran, Khorassan Province, Qanats.

Seismological data are presented of the very destructive earthquake that occurred August 31, 1968 in Khorassan Province, northeastern Iran. An analysis is made of the regional intensities, the effects on local structures, and the fresh surface faulting phenomenon. Results are given of studies of temporal and spatial characteristics and the magnitude of all recorded seismic activity before, after and including the major event. Having a magnitude of 7.3, the quake destroyed or severely damaged several villages resulting in 10,000 fatalities and 60,000 homeless residents. The measured fault length was 25 kilometers and surface fractures were noted in many areas. Maximum horizontal displacement was a left-lateral movement of 4.1 meters east of Dasht-e Bayaz, 250 Km southwest of Mashad. Extensive property damage is attributed mostly to poor construction but also to the location of some of the villages on alluvium with a shallow water table. Qanats (shallow well systems) in some places ran dry but irrigation wells 30 meters or more deep were undamaged. (Land-USGS)
W70-09554

DESIGN AND DEVELOPMENT OF A ROCK TUNNELLING MACHINE,
McAlpine (Robert) and Sons Ltd., London (England).
N. D. Pirrie.
Tunnels and Tunnelling, Vol 2, No 2, p 98-103, Mar-Apr 1970. 5 p, 12 fig.

escriptors: Tunneling, *Tunneling machines, Tunnel construction, Tunnel linings, Rock excavation, Rock properties, Construction, Axial oads, Overbreak, Foreign construction, Costs, orque, Overloads, Rocks, Safety, Reliability, oreign design practices.
dentifiers: *Greenside-McAlpine tunneling achine, Great Britain, Machine design, Radial ads, Cutters, Tunnel supports.

he McAlpine tunneling machine, developed for se in soft ground and very soft rock, was quite successful in Great Britain in underground subway ork and in the Toronto Subway in Canada. For ck tunneling, McAlpine combined his machine ith the Greenside heading machine to produce e Greenside-McAlpine tunneling machine with a nall rotating cutting head of about 3 ft dia that averses along an arm rotating about a horizontal aft. The cutting head first enters the tunnel face the center then traverses outward while rotating the arm; all cutting forces are radial, not axial, d the breakout of rock is in tension to a free face. he tunneling machine and rock picks used on the tting head are described. Better criteria are eeded for assessing the toughness, brittleness, and orasiveness of the rock to be cut. Costs can be duced in machine-bored tunnels; important enefits are: accurate profile, less disturbance of rrounding rock resulting in a safer tunnel, and ss support and lining costs with as much as 30% vings in concrete. (USBR)
70-09933

F. Concrete

HE EFFECTS OF WATER-SHOCK WAVES ON HYDRAULIC STRUCTURE,
alifornia State Coll., Los Angeles.
or primary bibliographic entry see Field 08A.
70-09855

HOTCRETE FOR TUNNEL AND SHAFT SUPORT,
alifornia State Dept. of Water Resources, Castaic.
irl A. Evans.
aper, Calif Water Project, Jan 1970. 46 p, 15 fig, photo.

escriptors: *Supports, *Tunnels, *Shafts (Exavations), Accelerators, Underground structures, pplication methods, *Pumped concrete, Design, unite, Concrete placing, Application equipment, ebound, *Performance, Tunnel linings, Producvity, Rock mechanics, Concrete mixes, Concrete ontrol, Concrete testing, Costs, Tunnel construcon, Instrumentation.

aterials, equipment, procedures, and testing used r shotcreting to provide primary and supplemenry support for tunnels and shafts on the California ate Water Project are described. Information resented is intended to five a basic working nowledge of the shotcrete method of rock suport, including design suggestions, mix design, pid set accelerator use, rock instrumentation, d shotcrete application procedures. The echanical process and sequence of failure around tunnel by stress rearrangement pressure is scussed and the action of shotcrete to prevent ilure is explained. Design formulas for shotcrete pport are presented. Performance data show that otcrete as primary support prevents rock relaxaon and is a practical support system. Shotcrete ows flexibility and compatibility in adding rength and economy to other support systems. erformance in the shafts shows that shotcrete one could have been uses as support. Comparing rout takes in a section of tunnel supported by otcrete to a section supported by steel and wood gging indicates that shotcrete gives better ground pport than other conventional systems. Shotcrete ccomplishes objectives, of good support, safety, w cost, and speed. (USBR)
70-09915

MASS CONCRETE FOR DAMS AND OTHER MASSIVE STRUCTURES.
American Concrete Inst., Detroit, Mich.

Journal of the American Concrete Institute, Proceedings, Vol 67, No 4, p 273-309, Apr 1970. 37 p, 7 fig, 14 tab, 52 ref.

Descriptors: *Mass concrete, *Concrete technology, Concrete additives, Concrete structures, *Concrete construction, *Concrete dams, Admixtures, History, Concrete placing, *Concrete mixes, Aggregates, Air entrainment, Cements, Mixing, Temperature control, *Materials, Durability, Formwork (Construction), Heat of hydration, Curing, Bibliographies, Behavior.
Identifiers: *Concrete properties, Volume change, Mix ratios.

A discussion is presented of the materials and practices employed in proportioning, mixing, placing, and curing mass concrete, and of the properties and behavior of hardened mass concrete. Particular emphasis is placed on mass concrete used in constructing concrete dams and other nonreinforced structures usually incorporating large-size coarse aggregate and on the differences between mass and conventional concrete. History of the development of mass concrete practices is presented. Concrete mixes and properties of several dams are tabulated. The report is designed to serve as a reference in designing and constructing concrete dams and other massive concrete structures. (USBR)
W70-09922

SHOTCRETING AT HECLA MINING COMPANY,
Hecla Mining Co.
Gordon M. Miner, and Robert S. Hendricks.
Proceedings, II Symposium on Rapid Excavation, p 7-21-7-37, Sabramento State College, Calif, Oct 1969. 17 p, 1 fig, 6 tab.

Descriptors: *Costs, *Supports, *Underground structures, *Application methods, *Pumped concrete, Concrete placing, Concrete technology, Wet condition, Dry condition, Specifications, Concrete mixes, Accelerators, Application equipment, Rebound, *Performance, Shafts (Excavations), Productivity, Mining, *Tunnel linings, Tunnels, *Gunite.
Identifiers: *Shotcrete, Cost savings, Underground openings, Stopes, *Sprayed concrete, Materials handling, Tunnel supports.

Hecla Mining Company has used successfully shotcrete with substantial cost savings for ground support purposes. Hecla's experience indicates that shotcrete is an extremely effective ground support material that can be used successfully in problem areas where various conventional systems would fail. Hecla's use of shotcrete has been limited to openings where long-term, high-quality support was required, to specific areas where exceptionally difficult ground conditions were encountered, and to a limited degree in stope support. When the necessary engineering and an efficient materials handling system have been accomplished, use of shotcrete on a routine basis in stoping and development situations is anticipated. Shotcreting is a continuous process as compared to the cyclic nature of all other support operations, and offers greater opportunity for mechanization. Therein lies its potential for incorporation into the total rapid excavation system. Operational characteristics of the wet and dry shotcrete processes are discussed. Several case studies are presented. (USBR)
W70-09926

8G. Materials

CHEMICAL GROUTING FOR PARIS RAPID TRANSIT TUNNELS,
Soletanche S A, Paris (France).
Jean J. Janin, and Guy F. LeSciellour.
Proceedings of the American Society of Civil Engineers, Journal of Construction Division, Vol 96, No CO1, p 61-74, June 1970. 14 p, 12 fig, 1 tab.

Descriptors: *Chemical grouting, *Grouting, *Tunnel construction, Soil stabilization, Tunneling, Underground structures, Construction, Control, Foreign construction, *Tunnels, Silicates, Cement grouting, Engineering geology, Cement grouts, Impregnation, Tunneling machines, Consolidation, Injection.
Identifiers: France, *Construction methods, Grouting pressure, Silica gel, Construction practices, Sodium silicate, Grout mixes.

Construction of subsurface structures for a new rapid transit railway line in a major, crowded city like Paris creates special problems. The 30-ft-dia tunnel runs below ground-water level through sands and gravels, underneath existing structures. A shield and mole are used for the excavation. Consolidation of soils is provided by chemical grouting. The technique is also used to consolidate the foundations of a bridge over the tunnel when crossing the Seine. A major station 750 ft long, 130 ft wide, and 60 ft high is excavated in difficult geological conditions complicated by existing services, railway tunnels in operation, and buildings. Silicate and resin grouting provide the consolidation without recourse to compressed air or dewatering. A classification of modern chemical grouts and their limits of injectability is given. Elaborate grouting procedures prove their efficiency in supplementing or replacing modern tunneling methods when grouting is thought to be a reliable construction procedure. (USBR)
W70-09921

8H. Rapid Excavation

RICHARD V KAUFMAN (DAMAGE TO SPRING CAUSED BY BLASTING OPERATIONS).
For primary bibliographic entry see Field 06E.
W70-10014

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

PROGRAM OF THE WATER RESOURCES DIVISION, TEXAS DISTRICT FOR THE 1970 FISCAL YEAR AND SUMMARY OF DISTRICT ACTIVITIES DURING FISCAL YEAR 1969.
Geological Survey, Austin, Tex. Water Resources Div.

U S Geological Survey Information Bulletin, February 1970. 35 p.

Descriptors: *Water resources, *Investigations, *Network design, *Texas, Bibliographies, Publications.
Identifiers: *Basic data network, *Information bulletin, State of Texas, USGS Water Resources Division.

The program of the U. S. Geological Survey, Water Resources Division in Texas consists of collection of basic records through the hydrologic-data network, interpretive studies, and research. This report summarizes the scheduled activities of the Water Resources Division in Texas for the 1970 fiscal year (July 1, 1969 to June 30, 1970) and includes a list of U. S. Geological Survey reports published or released during the fiscal year 1969. (Woodard-USGS)
W70-09836

10. SCIENTIFIC AND TECHNICAL INFORMATION

BIBLIOGRAPHY OF DESALTING LITERATURE - 1969.
Columbia Software, Inc., Fairfax, Va.
For primary bibliographic entry see Field 03A.
W70-09529

CURRENT TRENDS IN GLACIOLOGY,
Centre National de la Recherche Scientifique, Grenoble (France). Laboratoire de Glaciologie.
For primary bibliographic entry see Field 02C.
W70-09533

SEDIMENTATION, ANNOTATED BIBLIOGRAPHY OF FOREIGN LITERATURE, 1967-1968 SURVEY NO 5.
Department of Agriculture, Washington, D.C.; and National Science Foundation, Washington, D.C.
For primary bibliographic entry see Field 02J.
W70-09556

EFFECTS OF DEICING SALTS ON WATER QUALITY AND BIOTA-LITERATURE REVIEW AND RECOMMENDED RESEARCH,
Virginia Polytechnic Inst., Blacksburg.
For primary bibliographic entry see Field 05C.
W70-09705

THE FATE OF NITROGENOUS COMPOUNDS THROUGH SEWAGE TREATMENT PLANTS,
Washington Univ., St. Louis, Mo. Center for the Biology of Natural Systems.
For primary bibliographic entry see Field 05D.
W70-09907

SLUDGE TREATMENT DISPOSAL AND UTILIZATION (Literature Review),
For primary bibliographic entry see Field 05D.
W70-09935

BIOLOGICAL FILTERS, (LITERATURE REVIEW),
For primary bibliographic entry see Field 05D.
W70-09948

ANAEROBIC PROCESSES (LITERATURE REVIEW),
For primary bibliographic entry see Field 05D.
W70-10025

DETERGENTS (LITERATURE REVIEW),
For primary bibliographic entry see Field 05D.
W70-10028

LAGOONS AND OXIDATION PONDS (Literature Review),
For primary bibliographic entry see Field 05D.
W70-10031

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W70-09747 05D

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W70-09749 05D

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North Carolina Water Resources Research Institute	W70-09668 -- 09669	2
Wisconsin Water Resources Center	W70-09671 -- 09675	5
C. Other		
Illinois State Water Survey	W70-09524	1
Engineering Aspects of Urban Water Resources (Herbert G. Poertner)	W70-09796 -- 09802	7
Engineering-Sciences, Inc.	W70-09908	1

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2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

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SELECTED WATER RESOURCES ABSTRACTS

JAN 19 1971

VOLUME 3, NUMBER 24
DECEMBER 15, 1970

W70-10034 -- W70-10500

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 3, NUMBER 24
DECEMBER 15, 1970

W70-10034 -- W70-10500

of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.

- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the FWPCA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

In cooperation with the Federal Water Pollution Control Administration, the following "centers of competence" have been established:

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

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06 WATER RESOURCES PLANNING
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07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
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09 MANPOWER, GRANTS, AND FACILITIES
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. NATURE OF WATER

REVIEW OF THE 1969 LITERATURE ON WSTE WATER AND WATER POLLUTION NTROL.
nal Water Pollution Control Federation, Vol No 6, p 863-1268, June 1970. 405 p, 3,143 ref.

criptors: *Reviews, *Water pollution control, ste disposal, *Waste water disposal, Waste tment, Activated sludge, Biodegradation, In- rial wastes, Economics, Estuaries, Ground- r, Water pollution sources, Path of pollutants, age, Sewers, Thermal pollution, Urbanization, er supply, Bibliographies, Publications.
tifiers: *Literature reviews.

erature review by the Research Committee of Water Pollution Control Federation covers: ytical methods (analysis of anions, cations, and s; and instrumentation), biological filters, ac- ed sludge, detergents, anaerobic processes, ge treatment, disinfection, water reclamation reuse, storm flow, facilityevaluation, kinetic els, physical and chemical waste water treat- t, effects of pollution on aquatic life, eutrophi- n, thermal pollution, microbiology, oxygen groundwater, marine and estuarine pollution, nomics of treatment, standards, and industrial es (paper, fermentation, meat, dairy, canning, , tannery, steel, petroleum, plating, chemical, radioactive). (Knapp-USGS)
-10267

. Properties

DROGEN BONDING AND POLYWATER IN Y-WATER SYSTEMS,
lue Univ., Lafayette, Ind. Dept. of Agronomy.
p F. Low, and Joe L. White.
s and Clay Minerals, Vol 18, No 1-E, p 63-66,). 4 p, 1 fig, 52 ref.

criptors: *Clay minerals, *Water structure, ter properties, *Hydrogen bonding, Water erties, Water chemistry.
tifiers: Clay-water systems, Polywater.

der to explain the long-range alteration of the erties of water by clay surfaces, it is postulated an ordered water structure is anchored to and agated away from these surfaces by hydrogen ling. There is indirect evidence that polywater, similar species of water, does exist in these ms. (Knapp-USGS)
-10278

WATER CYCLE

. General

DEL STUDIES OF TIDAL EFFECTS ON UNDWATER HYDRAULICS,
aii Univ., Honolulu. Water Resources arch Center.
primary bibliographic entry see Field 02F.
-10034

OF THE MASS BALANCE METHOD FOR MINING THE ROLE OF SOILS IN CON- LLING WATERSHED PERFORMANCE,
cultural Research Service, University Park, Pa. heast Watershed Research Center.
iwitz, E. T. Engman, and G. D. Cline.
r Resources Research, Vol 6, No 4, p 1115- , August 1970. 9 p, 3 fig, 2 tab, 12 ref.

riptors: *Rainfall-runoff relationships, *Water ice, *Hydrologic budget, *Subsurface runoff, water movement, Small watersheds, Percola- Topography, Hydrograph analysis.
ifiers: *Soil water-runoff relationships, Mass ice.

A two year preliminary study of the water balance of a 162-hectare watershed in Pennsylvania showed that spring and summer storms produced practically no overland surface runoff during the storms, but these storms did produce typical hydrographs having all the characteristics usually attributed to surface runoff. Less than 5% of the rainfall, and one third or less of the total runoff appeared as storm runoff. Since virtually all the water eventually reaching the stream channels infiltrated the soil and most of it percolated through the soil, the properties of the soil and the amount of water stored in this layer emerge as the most important regulators of runoff in the system. (Knapp-USGS)
W70-10064

APPLICATION OF THE CONVOLUTION RELATION TO ESTIMATING RECHARGE FROM AN EPHEMERAL STREAM,
Arizona Univ., Tucson. Hydrology and Water Resources.
Allen F. Moench, and Chester C. Kisiel.
Water Resources Research, Vol 6, No 4, p 1087-1094, August 1970. 8 p, 5 fig, 1 tab, 5 ref.OWRR Projects A-010 and B-007.

Descriptors: *Recharge, *Surface-groundwater relationships, *Mathematical models, Linear programming, Aquifers, Hydrogeology, Water level fluctuations, Unsteady flow, Dupuit-Forchheimer theory, Synthetic hydrology, Ephemeral streams, Input-output analysis.
Identifiers: Aquifer recharge models.

A linear model that permits calculation of recharge to the water table from a source of finite width and infinite length uses water level measurements made in an observation well near the source and independently estimated aquifer constants. The method requires determination of the input given the output (water level measurements) and the impulse response as a function of space and time. The latter is derived from the linear equations of groundwater motion for the particular geometry of this study. The input is obtained from the discrete form of the convolution integral by using the synthetic division method and is then summed over the appropriate time period to obtain total recharge. For the particular recharge event studies, results agree satisfactorily with an independent estimate of recharge and demonstrate that the convolution relation has practical application to groundwater flow problems. (Knapp-USGS)
W70-10067

APPLICATION OF LINEAR RANDOM MODELS TO FOUR ANNUAL STREAMFLOW SERIES,
Alaska Univ., College; and Wisconsin Univ., Madison.
Robert F. Carlson, A. J. A. MacCormick, and Donald G. Watts.
Water Resources Research, Vol 6, No 4, p 1070-1078, August 1970. 9 p, 12 fig, 2 tab, 11 ref.

Descriptors: *Streamflow forecasting, *Regression analysis, *Time series analysis, *Correlation analysis, Gaging stations, Data collections, Statistical methods, Statistics, Markov processes, Stochastic processes.
Identifiers: Hydrologic series, Streamflow series.

A simple method for describing random time series is illustrated by application to the annual streamflow data of the St. Lawrence, the Missouri, the Neva, and the Niger rivers. The techniques is illustrated for identifying the appropriate form of the general autoregressive moving average model by use of the sample autocorrelation function of each series. The values of the parameters of the suggested model of each series are estimated and the results checked to suggest further modification of the model. The best model for each of the four samples showed a reduction in the variance value to 0.49, 0.64, 0.59, and 0.62 of the original variance with the use of one or two parameters. The use of the model for one year ahead forecasting on the Missouri River data is shown. (Knapp-USGS)
W70-10069

SIMULATION OF SPATIAL AND TEMPORAL CHANGES IN WATER QUALITY WITHIN A HYDROLOGIC UNIT,
Montana State Univ., Bozeman. Dept. of Civil Engineering; and Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-10077

THE ATMOSPHERIC WATER BALANCE AND THE HYDROLOGY OF LARGE RIVER BASINS,
Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
James L. Rasmussen.
Water Resources Bulletin, Vol 6, No 4, p 631-639, July-August, 1970. 9 p, 5 fig, 1 tab, 20 ref. OWRR Project B-035.

Descriptors: *Water balance, *Synoptic analysis, *Colorado River Basin, Hydrologic budget, Rainfall-runoff relationships, Climatology, Meteorological data, Meterorology, Regions, Surveys, Evapotranspiration, Discharge (Water), Runoff forecasting, Streamflow forecasting.
Identifiers: Atmospheric water balance.

The concept of using the atmospheric water balance technique in the study of the hydrology of large river basins is described. The atmospheric water balance technique consists of determining the spatial and time distributions and fluxes of water vapor through the atmospheric volume overlying the basin. Precipitation minus evaporation at the earth's surface is determined as a residual of the computation. Results of experiments employing this technique are reviewed. The technique is demonstrated by the hydrometeorology of the Upper Colorado River Basin. The seasonal accumulation of water over the basin is highly correlated with annual runoff. The daily evaporation rate during dry days varies by a factor of 2 over the winter season, and is related to the incoming solar radiation intensity. (Knapp-USGS)
W70-10079

FLOW SERIAL CORRELATION AND RELATED STREAMFLOW GENERATION MODELS,
Washington State Univ., Seattle. Charles W. Harris Hydraulics Lab.
For primary bibliographic entry see Field 02E.
W70-10120

RUNOFF GENERATION IN WESTERN WASHINGTON AS A FUNCTION OF PRECIPITATION AND WATERSHED CHARACTERISTICS,
Washington State Univ., Pullman. Coll. of Engineering Research Div.
John S. Gladwell.
Available from NTIS as PB-194 461, $3.00 in paper copy, $0.65 in microfiche. Completion Report, College of Engineering, Research Division, Bulletin 319, June 1970. 341 p, 56 fig, 46 tab, 74 ref. OWRR A-028-WASH (1).

Descriptors: *Precipitation (Atmospheric), *Discharge (Water), *Hypsometric analysis, Variability, Geomorphology, Regression analysis, Synthetic hydrology, *Watersheds, Correlation analysis, *Runoff, *Rainfall-runoff relationships, Washington.

Twenty-nine watersheds of Western Washington are studied to establish relationships between precipitation and runoff as modified by physiographic characteristics. The relationships are studied using primary statistical parameters of the hydrologic series. It is established that the mean annual discharge and the mean annual hydrograph (using monthly sub-units) are highly correlated to watershed hypsometry. The standard deviation of annual discharge is shown to be generally predictable on the basis of precipitation data; it is also found to be a linear function of the mean annual discharge. Precipitation skewness and kurtosis are shown to be roughly defineable by geographic delineations. Runoff skewness is generally less than

that of precipitation. Kurtosis of runoff is less easily defined but generally has a value of less than three. Annual precipitation appears to be serially correlated, and the correlogram of runoff is shown to be highly correlated to that of precipitation. Cross-correlations of precipitation and of runoff series are shown to be functions of proximity and of a directional component. Harmonic analyses of the runoff and precipitation series indicate strongly that cycles of approximately 16.5 and 5.5 years may exist.
W70-10122

SELECTION OF FREQUENCY DISTRIBUTION MODELS,
Nevada Univ., Reno.
Vulli L. Gupta.
Water Resources Research, Vol 6, No 4, p 1193-1198, August 1970. 6 p, 1 fig, 3 tab, 22 ref.

Descriptors: *Mathematical models, *Statistical models, *Statistical methods, Statistics, Frequency analysis, Hydrologic data, Data processing, Computer programs, Parametric hydrology, Regime, Floods, Droughts.
Identifiers: Frequency distribution models.

A method is considered for selecting mathematical models to fit frequency distributions of hydrologic data among ten commonly used methods of frequency analysis. The methods are those of Gumbel, Lieblein, Chow, and the seven types of Gringorten. The best fitting model is chosen on the basis of comparison for goodness of fit indicated by the coefficients of determination. Friedman's non-parametric statistical test was employed to detect significant differences between the models. (Knapp-USGS)
W70-10246

WATER RESOURCES PROBLEMS: PRESENT AND FUTURE REQUIREMENTS FOR LIFE,
For primary bibliographic entry see Field 06D.
W70-10312

2B. Precipitation

A CRITIQUE OF METHODS SIMULATING RAINFALL,
Imperial Coll. of Science and Technology, London (England).
M. J. Hall.
Water Resources Research, Vol 6, No 4, p 1104-1114, August 1970. 11 p, 3 fig, 1 tab, 43 ref.

Descriptors: *Rainfall simulators, *Artificial precipitation, *Simulated rainfall, *Reviews, *Hydraulic models, Model studies, Equipment, Instrumentation, Design, Research equipment.
Identifiers: Rainfall simulation research.

In natural rainfall the range of drop sizes increases with increasing rainfall intensity. If a network of nozzles is used to generate artificial rainfall, an increase in working pressure increases the average intensity but decreases the range of drop sizes within the spray. This property has hindered the development of the rainfall simulator more than any other single factor. Alternative methods of simulating rainfall, which depend upon individual drop forming elements such as hypodermic needles for example, are capable of producing sprays with uniform drop sizes only. Such methods have been employed successfully in generating storm patterns involving both temporal and spatial variations in intensity for laboratory catchment studies. A general purpose rainfall simulator, combining control of application rates in both space and time with the reproduction of the drop size distributions and velocities of fall of drops observed in nature, has yet to be developed. (Knapp-USGS)
W70-10065

THE nTH ROOT NORMAL DISTRIBUTION OF PRECIPITATION,
Nevada Univ., Reno. Center for Water Resources Research.
Charles K. Stidd.
Water Resources Research, Vol 6, No 4, p 1095-1103, August 1970. 9 p, 9 fig, 3 tab, 12 ref.

Descriptors: *Time series analysis, *Precipitation (Atmospheric), Data collections, Synthetic hydrology, Simulation analysis, Statistics, Statistical methods, Runoff forecasting.
Identifiers: Synthetic precipitation series.

A computer-generated stationary time series was modified by processes analogous to those that produce precipitation. The resulting numbers have the distributional characteristics of precipitation data. A quantitative explanation is thereby obtained for the skewness in precipitation distributions, and the nth root normal distribution is verified. (Knapp-USGS)
W70-10066

A FAST, APPROXIMATIVE METHOD FOR INTEGRATING THE STOCHASTIC COALESCENCE EQUATION,
National Center for Atmospheric Research, Boulder, Colo.
Rainer Bleck.
Journal of Geophysical Research, Vol 75, No 27, p 5165-5171, September 20, 1970. 7 p, 8 fig, 10 ref.

Descriptors: *Raindrops, *Condensation, *Cloud physics, *Stochastic processes, Statistics, Statistical models, Meteorology, Atmospheric physics, Precipitation (Atmospheric).
Identifiers: *Stochastic coalescence (Raindrops), Raindrop coalescence.

The use of mean values of the raindrop number density in the coalescence equation is shown to lead to a system of ordinary differential equations that provide good approximative solutions with a minimum of computational efforts. The coefficients in this system of equations are functions of the kernel and can be obtained by simple quadrature. Comparisons are made between numerical and analytic solutions for two types of kernels (constant and sum of arguments), using a Gaussian initial distribution of cloud droplets. Systematic deviations of the numerical results from corresponding analytic solutions are shown to depend on the choice of variables, and methods to suppress these deviations are discussed. (Knapp-USGS)
W70-10270

2C. Snow, Ice, and Frost

DROPLET FREEZING BY SURFACE NUCLEATION,
State Univ. of New York, Albany.
Narayan R. Gokhale, and James Goold, Jr.
Journal of Applied Meteorology, Vol 7, No 5, p 870-874, October 1968. 5 p, 4 fig, 1 tab, 10 ref. NSF Grant No GA-328.

Descriptors: *Freezing, *Cloud seeding, *Silver iodide, *Clay minerals, *Nucleation, Cloud physics, Supercooling, Crystallization, Temperature, Snow, Particle size, Crystallography.
Identifiers: Surface nucleation.

Droplet freezing by surface nucleation has been observed during the course of studies of ice nucleation. A constant rate of cooling apparatus and a specially constructed cold chamber were used for this study. Silver iodide particles sprinkled on supercooled, millimeter-size water drops are effective in freezing the drops at -5C. Particles of naturally occurring silicates were found to be effective in the range -7 to -10C. Thus, the ice nucleating ability of such dry particles is much greater by the surface contact mechanism than when particles are embedded in the drops. The importance of the surface nucleation mechanism in forming solid hydrometeors in cumulus clouds is discussed. (Knapp-USGS)
W70-10091

PERMAFROST PRESENTS MECHANICAL CHALLENGES,
Kroeker (J. Donald) and Associates, Portland, Oreg.
For primary bibliographic entry see Field 08A.
W70-10144

NATURAL FREEZING AND THAWING IN A SILT AND A SAND.
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard A. Sartz.
Soil Science Vol 109, No 5, p 319-323, 1970.

Descriptors: *Frozen soils, *Impervious soils, *Thermal properties, *Soil water, *Physical properties, Porosity, Soil texture, Hydrologic properties, Wisconsin.

Since it can affect infiltration and soil water storage, soil freezing often affects the hydrology of northern watersheds under winter and early spring conditions. The rate at which different soils freeze and thaw varies with their physical properties as well as with the temperature gradient. Depth of frost penetration and rate of freezing and thawing were studied in field profiles of a sandy and a silty soil. Frost depth was measured by penetrometer and resistance blocks and rate of freezing and thawing at a given depth were determined by gradual changes in resistance block readings. Although the two soils began to freeze at the same time, frost penetrated faster and deeper and thawed sooner in the sandy soil. During the spring thaw frost persisted in the silt 3 weeks longer than in the sand. Frost undergoes gradual changes during freezing and thawing that may affect its permeability. (Sartz-Forest Service)
W70-10411

SOIL WATER MOVEMENT AS AFFECTED BY DEEP FREEZING,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02G.
W70-10414

A DEVICE FOR MEASURING SOIL FROST,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W70-10415

NICHOLS V CITY OF MORRISTOWN (LIABILITY FOR INJURY DUE TO INADEQUACY OF CREEK TO ACCOMMODATE SURFACE WATER).
For primary bibliographic entry see Field 02E.
W70-10483

2D. Evaporation and Transpiration

EVAPORATION OF BRINE: A FIELD STUDY ON THE BONNEVILLE SALT FLATS, UTAH,
Texas Univ., Austin.
L. J. Turk.
Water Resources Research, Vol 6, No 4, p 1209-1215, August 1970. 7 p, 4 fig, 4 tab, 18 ref.

Descriptors: *Evaporation, *Brines, Utah, Salinity, Water vapor, Solar radiation, Vapor pressure, Hydrologic budget, Water balance, Evaporation pans.
Identifiers: Bonneville Salt Flats.

Evaporation rates were determined for several brines of average specific gravities from 1.207 to 1.333. Evaporation of the brines ranged from 70%

5%, respectively, of the freshwater evapora-
ate. The field data agree exceptionally well
differential vapor pressures over Great Salt
brine. Water occasionally condenses on the
er brines because of an inverted vapor pres-
gradient. (Knapp-USGS)
10059

ROVEMENTS IN THE VAN BAVEL-MYERS
OMATIC WEIGHING LYSIMETER,
aska Univ., Lincoln.
rimary bibliographic entry see Field 07B.
10062

-WATER MOVEMENT AND
POTRANSPIRATION: CHANGES IN THE
OPIC COMPOSITION OF THE WATER,
elberg Univ. (West Germany). Physikalisches
it (II).
rimary bibliographic entry see Field 02K.
10104

GATION REQUIREMENTS FROM
PORATION,
Water Research Lab., Logan.
Christiansen, and G. H. Hargreaves.
th Congress on Irrigation Drainage, Quest 23,
Disc, Part 2, R24-R45, Mexico City, p 23.569-
6, 1969. 28 p, 11 tab, 28 ref.

riptors: Irrigation, *Evaporation,
potranspiration, Equations, *Consumptive
rrigation efficiency, Irrigation water, Coeffi-
, *Irrigation operation and maintenance,
graphies, Water requirements, Methodology,
ating, Forecasting, *Irrigation practices,
duling, Crops.
ifiers: *Irrigation requirement, *Pan evapora-
Christiansen-Mehta Form, *Potential
transpiration, Potential evaporation.

vaporation, as measured with a Class A pan
standardized conditions, is a reliable index of
te as it pertains to evapotranspiration. Pan
oration is being measured in many places in
world, but when not available, may be esti-
d from many formulas, some of which are in-
d here. Potential evapotranspiration can be
ated from pan evaporation or computed
ly from radiation and climatic data.
otranspiration varies with crops, but can be
ated best from potential evapotranspiration or
ly from pan evaporation. Three formulas are
nted for estimating Class A pan evaporation
for estimating potential evapotranspiration.
e formulas may be applied in either English or
c units. Coefficients are presented from which
l evapotranspiration may be estimated from
r measured or estimated pan evaporation, or
estimated potential evapotranspiration. Ir-
on water requirements depend basically upon
otranspiration, but also depend upon
pitation and water application efficiency. As
resources become more limiting, the need for
r estimates of evapotranspiration will in-
e. (USBR)
10141

POTRANSPIRATION BY WOODY
EATOPHYTES IN THE HUMBOLDT
ER VALLEY, NEAR WINNEMUCCA,
ADA,
ogical Survey, Washington, D.C.
Robinson, and A. O. Waananen.
ale by the Superintendent of Documents, US
rnment Printing Office, Wash, DC, 20402 -
55 cents. US Geological Survey Professional
r 491-D, 1970. 41 p, 26 fig, 11 tab, 9 ref.

riptors: *Evapotranspiration, *Phreatophytes,
ada, Rabbitbrush, Willow trees, Arid cli-
s, Alluvial channels, Consumptive use, On-site
Lysimeters, Water levels, Water table,
ndwater.
ifiers: Winnemucca (Nev), Humboldt River
).

Evapotranspiration by phreatophytes was studied in the Winnemucca reach of the Humboldt River valley, Nevada. Water that is wasted by evapotranspiration from areas of low beneficial phreatophytes is one of the largest unknowns in the water budget of the reach. Twelve tanks ranging in size from 30 feet square and 10.5 feet deep to 10 feet square and 7 feet deep were constructed. Seedlings of greasewood were planted in 2 tanks and rabbitbrush in 3 tanks; cuttings of willow were planted in 3 tanks and wildrose in 3 tanks. The twelfth was left bare. The tanks were operated during the growing season April 1 to October 20 from 1961-67, inclusive. Water metered into elevated reservoirs was supplied by gravity to the evapotranspiration tanks. Evapotranspiration by a given species of phreatrophytes is affected by climatic conditions, of which temperature is the most important. Water use by greasewood and rabbitbrush in April was only about 2% of the yearly total, whereas during the months of peak use it was 28%. More than two-thirds of the annual use occurred during June, July, and August. The annual use of water ranged rather widely over the study period, as the plants responded to the effect of plant damage, boron toxicity, depth of the water level, and warmth and length of the growing seasons. Draft from the water table, equivalent to the water supplied to the tanks, varied with the rainfall. It was greatest when rainfall was scant, and least when the rains were copious. (Knapp-USGS)
W70-10243

INFLUENCE OF SOLAR RADIATION REFLECTANCE ON WATER EVAPORATION,
Virginia Univ., Charlottesville. School of Engineering and Applied Science.
J. Taylor Beard, and John L. Gainer.
Journal of Geophysical Research, Vol 75, No 27, p 5155-5163, September 20, 1970. 9 p, 6 fig, 5 tab, 21 ref. OWRR Project A-019-VA and USBR Contract 14-06-D-6385.

Descriptors: *Evaporation control, *Monomolecular films, *Solar radiation, *Albedo, Reservoir evaporation, Alcohols, Oil, Dye releases.
Identifiers: Reflectance, Colored monolayers.

Evaporation in water reservoirs may be reduced by increasing the reflectance of solar energy. Such a change in reflectance will require a surface modification such as the application of a special surface film or monolayer with good reflecting properties. Colored monolayers and artificially dyed monolayers were studied experimentally. A large number of dyes were investigated, but in no instance did the dyes color the monolayer or form a monolayer themselves. A yellow silicone oil film on a water surface was found experimentally to relect solar energy about 1.7 times better than a plain water surface and also to reduce the evaporation rate. In addition, the film was extremely difficult to remove from a water surface. The transient energy equation for an element of a water surface was solved by numerical methods. The analytical model gave an average evaporation suppression by cetyl alcohol of 22.6%, which is consistent with previous experimental work. Results for monolayers with hypothetical reflectance properties and with the diffusion properties of a cetyl alcohol monolayer showed average evaporation reductions of 25 to 45%, depending on the reflection properties. (Knapp-USGS)
W70-10271

IMPROVING TREE TRANSPIRATION ESTIMATES BASED ON HEAT PULSE VELOCITY MEASUREMENTS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
Robert H. Swanson.
International Union Forestry Research Organization Congress, Sept 4-9, 1967, Munich, Germany, Vol 1, Section 11, p 252-263, 1967. 6 fig, 8 ref.

Descriptors: *Transpiration, *Trees, *Respiration, *Circulation (Plants), Consumptive use, Analytical techniques, Heat flow, Density.
Identifiers: Heat pulse velocity (Trees).

To estimate tree transpiration from heat pulse velocity, the mean sap flux and the area of the sap stream in cross section must be known. Sap flux is computed from heat pulse velocity, wood moisture content, density, and specific heat. This paper shows that the cross-sectional area within which sap ascends, the moisture content, and density of the conducting wood are not constant. Changes in these values must be considered before comparative transpiration estimates from heat pulse velocity are made. (Knapp-USGS)
W70-10286

THE EXPECTED EFFICIENCY OF WATER UTILIZATION IN PLANTS UNDER DIFFERENT COMPETITION AND SELECTION REGIMES,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
D. Cohen.
Israel Journal of Botany, Vol 19, No 1, p 50-54, March 1970. 4 ref.

Descriptors: *Water utilization, *Efficiencies, *Photosynthesis, *Transpiration, *Competition, Stomata, Semiarid climates, Climatology, Soil moisture, Soil surfaces, Plant physiology, Root systems, Consumptive use, Soil-water-plant relationships.
Identifiers: *Selection, Mediterranean climates.

The ratio of net photosynthesis to transpiration may be called the efficiency of water utilization for photosynthesis. Since changes in such factors as temperature, humidity, and light intensity influence rates of photosynthesis and transpiration, the ratio shows great daily and seasonal variation. If plants open their stomata only when efficiency is high, then plants will grow slowly but efficiently. However, if plants open their stomata when efficiency is low, then they grow quickly but inefficiently. Competition and selection appear to favor plants which grow quickly and remove soil water before it can be utilized by slow-growing plants. Therefore, high efficiency should occur naturally only if root systems of individual plants are not near the soil surface and do not overlap the root systems of other plants. This paper is based on studies of plant water utilization in Mediterranean climates. (Carr-Arizona)
W70-10294

EVAPOTRANSPIRATION ESTIMATES IN A SEMIARID CLIMATE,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
W. L. Pelton, and H. C. Korven.
Canadian Agricultural Engineering, Vol 11, No 2, p 50-53, 61, November 1969. 4 fig, 1 tab, 16 ref.

Descriptors: *Evapotranspiration, *Equations, *Irrigation practices, *Scheduling, *Semiarid climates, Alfalfa, Water requirements, Irrigation efficiency, Irrigation, Timing, Meteorological data, Lysimeters, Estimating, Estimating equations.
Identifiers: *Saskatchewan (Canada), *Penman equation, *Thornthwaite equation *Blaney-Criddle equation, *Irrigated agriculture, Canadian Prairie.

Three methods of estimating evapotranspiration from meteorological data were tested on irrigated alfalfa (Medicago sativa) at Swift Current, Saskatchewan, Canada. For 53 days during the 1967 growing season lysimeter observations were compared to evapotranspiration estimates from the Penman, Thornthwaite, and Blaney-Criddle equations. The latter two methods predicted weekly water requirements of alfalfa with reasonable accuracy, but described actual daily evapotranspiration inadequately. Although the Penman equation would require modification before being acceptable for general use on the Canadian Prairie, it was able to account for 65 percent of the variation in daily evapotranspiration. Further evaluation is necessary to test these equations for monthly and seasonal use. (Carr-Arizona)
W70-10297

EVAPORATION--RAIN FALLING UP,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.

Charles A. Troendle, and James D. Phillips.
West Virginia Agriculture and Forestry Vol 3, No 2, p 5, 11, 12, Spring 1970.

Descriptors: *Evaporation, *Evapotranspiration, *Solar radiation, Advection, Air temperature, Climatic data, Humidity, Wind velocity, West Virginia.
Identifiers: *Evaporation pan, Barometric pressure, Daily evaporation, Lake evaporation.

Data collected at the U. S. Weather Bureau Climatic Station at the Timber and Watershed Laboratory in Parsons, W. Va. were used for a twofold analysis. First, equations were developed for estimating daily pan evaporation from solar radiation, wind speed, air and water temperatures, and barometric pressure. The best overall estimator of pan evaporation was: Pan Evaporation—Daily Radiation..Mean Air Temperature. Then, the factor used to estimate potential evapotranspiration from pan evaporation was corrected for local climatic conditions. The corrected factor averaged 0.78 for May through September. (Troendle-Forest Service)
W70-10419

THE RADIANT ENERGY BUDGET OF CLEARCUT AND FORESTED SITES IN WEST VIRGINIA,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
J. W. Hornbeck.
Forest Science Vol 16, No 2, June 1970, p 139-145.

Descriptors: *Albedo, *Energy budget, *Snow cover, *Solar radiation, Advection, Air temperature, Climatology, Convection, Evapotranspiration, Heat balance, Heat transfer, Microclimatology, Radiation, Wind velocity, Clear-cutting, West Virginia.
Identifiers: *Hardwood forests, Radiant energy budgets, Radiometers.

Radiant energy budget components were measured over a clearcut site and a hardwood forest site on a gaged watershed in West Virginia. Results show that clearcutting caused changes in both albedo and upward thermal radiation values. The magnitude of these changes varied by season of the year. The clearcutting had an albedo that was nearly constant at 14 percent during snowfree conditions but ranged up to 83 percent during periods of snow cover. On the other hand, the forest albedo ranged from 14 percent for a leafless and snowfree period to about 20 percent for full leaf conditions and to 32 percent during periods of snow cover. The clearcutting had greater upward thermal radiation losses except during periods of snow cover when both sites were nearly identical. Despite the seasonal variability, net radiation values for the two sites did not differ greatly except during periods of snow cover. (Hornbeck-Forest Service)
W70-10422

2E. Streamflow and Runoff

LEAST SQUARES ESTIMATION OF CONSTANTS IN A LINEAR RECESSION MODEL,
Kentucky Univ., Lexington.
For primary bibliographic entry see Field 06A.
W70-10052

VALUE OF STREAMFLOW DATA FOR PROJECT DESIGN-A PILOT STUDY,
Geological Survey, Fort Collins, Colo.; Colorado State Univ., Fort Collins; Corps of Engineers, Sacramento, Calif; and Geological Survey, Washington, D.C. Hydrologic Systems Lab.
S. R. Dawdy, H. E. Kubik, and Edward R. Close.
Water Resources Research, Vol 6, No 4, p 1045-1050, August 1970. 6 p, 2 fig, 2 tab, 7 ref.

Descriptors: *Streamflow forecasting, *Planning, *Stochastic processes, *Simulation analysis, *Data collections, Design, Statistical methods, Statistics, Data processing, Water yield, Cost-benefit analysis, Synthetic hydrology, Water costs, Reservoir desing, Hydraulic design.

The value of streamflow data for project design is related to benefits forgone because of insufficient streamflow data. Stochastic simulation of a long-term hypothetical record for a sample station is used to determine a reservoir design based on full (hypothetical) information. Shorter segments of the long-term trace are then used for design under the same criteria in order to compute benefits forgone as a result of lack of full information. For the station used in this study, a low mean flow, high variability station, the marginal value of streamflow data approaches the marginal cost at some time beyond the length of 100 years. The manner in which the value of streamflow data for project design can be evaluated is illustrated. (Knapp-USGS)
W70-10056

OPTIMUM OPERATING PROCEDURE FOR A RIVER GAGING STATION ESTABLISHED TO PROVIDE DATA FOR DESIGN OF A WATER SUPPLY PROJECT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07A.
W70-10057

A NUMERICAL SOLUTION FOR FINITE AMPLITUDE FREE SURFACE WAVES,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 07C.
W70-10060

THE FRICTION COEFFICIENT FOR SHALLOW FLOWS OVER A SIMULATED TURF SURFACE,
University of the West Indies, St. Augustine (Trinidad).
H. O. Phelps.
Water Resources Research, Vol 6, No 4, p 1220-1226, August 1970. 7 p, 2 fig, 1 tab, 7 ref.

Descriptors: *Overland flow, *Roughness (Hydraulic), *Turf, *Hydraulic models, Fluid friction, Reynolds number, Energy losses, Discharge (Water), Flow resistance, Hydraulics, Porous media, Flumes, Mathematical models, Laminar flow, Turbulent flow.
Identifiers: Overland flow over turf.

The friction coefficient of rough surfaces must be known for the application of the basic momentum and continuity equations to the modeling of overland flow. Flume experiments on steady, uniform flows in the laminar and transitional regions over a simulated turf surface provide the data required to investigate the general hydraulic roughness properties of natural turf, and the particular parameters that are likely to influence the friction coefficient. Because boundary geometry depends on flow depth, this factor must be considered in calculating the relationship between friction coefficient and Reynolds number. By maintaining constant depths while varying the Reynolds number, the separate effects of boundary geometry and Reynolds number on the friction coefficient are demonstrated. The results, which are presented in the form of a friction coefficient chart, may be rationally explained if the simulated turf is considered to be a complex porous medium in which the boundary geometry is variable. (Knapp-USGS)
W70-10061

THE MEASUREMENT OF GRADATION USING SURVEYED CROSS SECTIONS,
Forest and Range Experiment Station, Rangiora (New Zealand).
F. A. Johnson.
Water Resources Research, Vol 6, No 4, p 1230-1234, August 1970. 5 p, 7 fig, 1 tab, 1 ref.

Descriptors: *Stage-discharge relations, *Alluvia channels, *Hypsometric analysis, *Slopes, *Cross sections, Profiles, Surveys, Streams, Channe morphology, Elevation.
Identifiers: Stream channel surveying.

A variation of hypsometric analysis gives quantita tive information on relative changes within a rive cross section. Area-elevation curves and area distance curves determine the degree of activity segments of a cross section. (Knapp-USGS)
W70-10063

THE nTH ROOT NORMAL DISTRIBUTION O PRECIPITATION,
Nevada Univ., Reno. Center for Water Resourc Research.
For primary bibliographic entry see Field 02B.
W70-10066

ESTIMATING COEFFICIENTS OF A FLO GENERATOR FOR MONOTONE SAMPLES O DATA,
American Univ., Washington, D.C.; and Geologic Survey,
For primary bibliographic entry see Field 07A.
W70-10068

EVOLUTION OF TIDEWATER PORT,
Tulane Univ., New Orleans, La. School of E gineering.
For primary bibliographic entry see Field 08B.
W70-10088

STREAM GAUGING TECHNIQUES FO REMOTE AREAS USING PORTABLE EQUI MENT,
British Columbia Univ., Vancouver. Dept. of Geo raphy; and Research Council of Alberta, Edmo ton.
For primary bibliographic entry see Field 07B.
W70-10090

CAPABILITIES AND POTENTIAL OF USAE CURRENT METER FOR ULTRA-LO VELOCITY MEASUREMENTS,
Tennessee Valley Authority, Norris.
For primary bibliographic entry see Field 07B.
W70-10108

THE FLOW OF A STREAM THROUGH RESERVOIR,
Gemeinnutziges Institut, Duesseldorf (West G many).
K. Sauerwein.
In: Isotopes in Hydrology, Proceedings Symposi of International Atomic Energy Agency and Int national Union Geodesy and Geophysics, Vien Nov 14-18, 1966: International Atomic Ene Agency STI/PUB/141, Vienna, Paper No S 83/48, p 697-719, 1967. 23 p, 14 fig, 1 tab.

Descriptors: *Currents (Water), *Reservoi *Tracers, *Radioisotopes, Radioactiv techniques, Dye releases, Streamflow, Mixi Dispersion.
Identifiers: Reservoir flow.

If a reservoir is fed from a single source, which m not always be pure, the extent to which the inflo ing stream mixes with the water in the reservoi important for the quality of the water supplied the reservoir. The question was investigated at Lingese Reservoir, containing between one a two million cubic meters of water, in the Bergisch Land (North Rhine-Westphalia). The investigati was carried out at four different seasons so that varying effects of the stream-water temperatu could be studied in relation to the temperature the reservoir water. The stream was radioactiv labeled at the point of inflow into the reservoir, a its flow through the reservoir was measured length and depth from boats, by means of l-m-lo

Geiger counters. Comparisons were made with simultaneously performed dye and slat experiments, but the four isotope experiments carried out at different seasons were found to be more suitable than the other procedures for investigating limnological processes and evaluating them quantitatively. (Knapp-USGS)
W70-10111

FLOW SERIAL CORRELATION AND RELATED STREAMFLOW GENERATION MODELS,
Washington State Univ., Seattle. Charles W. Harris Hydraulics Lab.
William J. Stolte, and Eugene P. Richey.
Available from NTIS as PB-194 459, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Charles W. Harris Hydraulics Laboratory Technical Report No. 29, June 1970. 154 p, 23 fig, 6 tab, 35 ref. OWRR A-035-WASH (1).

Descriptors: Hydrology, Stochastic processes, Runoff, Climatic factors, Flow, *Flow characteristics, Model studies, *Hydraulic models, Synthetic hydrology, Washington, Statistical models, River basins, Regression analysis.

The goal of the research was to investigate both the mathematical and physical aspects of flow generation processes. The mathematical aspect of the study indicated that the statistics of annual and monthly flows are intrinsically related. Therefore it is desirable that generated monthly flows should yield acceptable annual flows. Multiple regression equations incorporating from 1 through 12 preceding flows as predictor variables were used to generate monthly flows from which annual flows were derived. The statistics of both the monthly and annual flows gained by this process, were compared to those of the recorded flows in order to determine the accuracy of flow generation by these models and to choose the most acceptable model. It was found that the lag 1 model was the most desirable but that it had deficiencies in some respects. The physical aspect of flow generation was studied by determining the physical causes of, and prediction equations for, a poorly understood component of the lag 1 flow generation model, namely, the lag one serial correlation coefficient. It was found that the influence of climate on the serial correlation coefficient strongly predominates over that of basin characteristics in the region studied. It was concluded that groundwater storage was not of great importance in the variation in the flow serial correlation from basin to basin. It was also found that the prediction equations for the lag one serial correlation coefficient were deficient in some respects and could not be used with great confidence. More work is needed in developing accurate indices of the various physical causes influencing the flow regime. These results are not necessarily applicable to other regions where climatological and geographic conditions are different from those of Western Washington.
W70-10120

INTERNAL CURRENTS RESULTING FROM INTERMEDIATE DENSITY INFLOWS INTO STRATIFIED RESERVOIRS,
Washington Univ., Seattle. Charles W. Harris Hydraulics Lab.
Walter F. Rittall, and Bruce W. Hunt.
Available from NTIS as PB-194 460, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Charles W. Harris Hydraulic Laboratory, Technical Report 28, June 1970. 32 p, 17 fig, 5 ref. OWRR A-023-WASH (1).

Descriptors: *Stratified flow, *Hydraulic jump, Density currents, *Reservoir, Flow, *Density stratification, Depth, Froude number, Reynolds number, Slopes, *Open channel flow.

An experimental study has been made of the flow pattern which results when an inflow of intermediate density enters along the sloping bottom of a two-layer, density-stratified reservoir. It was found that a hydraulic jump may form within the reservoir at the fluid interface, and much of the study was focused upon the characteristics of this jump. It was found during the course of the study that the ratio of downstream to upstream jump depth depends mainly upon the ratio of densities across the top fluid interface, the channel slope, a densimetric Froude number, and a Reynolds number. Difficulties arose during the study because of the impossibility of controlling both the Reynolds and Froude numbers simultaneously. However, by combining the results of this study with two other related studies, it was found possible to extrapolate approximate depth relationships for flows at higher Reynolds numbers.
W70-10121

RUNOFF GENERATION IN WESTERN WASHINGTON AS A FUNCTION OF PRECIPITATION AND WATERSHED CHARACTERISTICS,
Washington State Univ., Pullman. Coll. of Engineering Research Div.
For primary bibliographic entry see Field 02A.
W70-10122

ADAMS V TOWN OF RUSTON (ACCELERATED EROSION OF NATURAL STREAM BY DISCHARGE OF SWIMMING POOL WATER).

194 La 403, 193 So 688-690 (1940).

Descriptors: *Louisiana, *Swimming pools, *Drainage, *Accelerated erosion, Bank erosion, Degradation (Stream), Soil erosion, Stream erosion, Damages, Superimposed drainage, Drainage practices, Drainage water, Riddance (Legal aspects), Ditches, Swimming, Cities, Judicial decisions, Legal aspects, Water injury, Natural streams, Water conveyance, Drainage systems, Drainage programs, Discharge (Water), Property values.

Plaintiff downstream landowner sought an injunction to prevent defendant city from periodically emptying swimming pool water into a natural drain which traversed plaintiff's unimproved land. Plaintiff claimed the swimming pool water had eroded the drain, causing a diminution in his property value. The court found that the swimming pool water did not cause the drain to overflow its bank, and that the damage to plaintiff was negligible. The court did not consider defendant's contention that since plaintiff had not complained for eight years, he was estopped from seeking an injunction. Since plaintiff could be adequately compensated by money damages, the court denied the injunction. (Hart-Florida)
W70-10216

QUANTITY AND CHEMICAL QUALITY OF LOW FLOW IN THE PRAIRIE DOG TOWN FORK RED RIVER NEAR WAYSIDE, TEXAS, FEBRUARY 6-9, 1968,
Geological Survey, Austin, Tex.
J. N. Lee, and M. L. Maderak.
Published and distributed by Texas Water Development Board, P. O. Box 12386, Austin, Texas 78711. Texas Water Development Board Report 116, May 1970. 11 p, 2 fig, 3 tab.

Descriptors: *Low flow, *Water quality, *Discharge (Water), *Solutes, *Texas, Streamflow, Chlorides, Saline water, Water chemistry, Texas.
Identifiers: Prairie Dog Town Fork Red River (Texas).

During the period February 6-9, 1968, water discharge in the Prairie Dog Town Fork Red River increased, in a downstream direction, from 0.19 cfs at a point 1 mile below Lake Tanglewood (site 1) to 2.11 cfs near Wayside, Texas (site 69), a river distance of 40.2 miles. Five reaches had significant gains, four had significant losses, three reaches had no flow, and numerous reaches had smaller gains and losses between individual sites. There were no releases from Lake Tanglewood during this period. The quality of water deteriorated progressively downstream. Dissolved solids increased from 468 mg/liter at site 1 to 8,330 mg/liter at site 69. The chloride concentration increased from 28 mg/liter to 3,300 mg/liter. (Knapp-USGS)
W70-10229

TIME OF TRAVEL OF TRANSLATORY WAVES ON THE BRAZOS, LEON, AND LITTLE RIVERS, TEXAS,
Geological Survey, Austin, Tex.
Willard B. Miils.
Published and distributed by Texas Water Development Board, P. O. Box 12386, Austin, Texas 78711. Texas Water Development Board Report 115, April 1970. 14 p, 11 fig, 4 tab, 6 ref.

Descriptors: *Streamflow, *Flood routing, *Hydrographs, Texas, Recession curves, River forecasting, Runoff, Hydrography analysis, Water level fluctuations, Water levels.
Identifiers: Flood waves, Brazos River, Leon River, Little River (Texas).

Travel times of peaks for the 346.4-mile reach of the Brazos River between Whitney and Richmond varied from 213 hours at 1,000 cfs, to 92 hours at 40,000 cfs, to 168 hours at 100,000 cfs. Minimum travel time of peaks for the 82-mile reach between Leon River near Belton and Little River at Cameron varied from 57 hours for initial flow less than 15 cfs at Belton to 42 hours for initial flow above 200 cfs at Belton. Minimum travel time of peaks for the 65-mile reach between Little River at Cameron to Brazos River near Bryan varied from 30 hours for 1,000 cfs, to 22 hours for 3,500 cfs, to 25 hours for 65,000 cfs, to 34 hours for 134,000 cfs. Travel time was not consistent for any discharge, and was even more inconsistent in the low discharge range. Minimum peak travel time for each channel condition was fairly well defined. (Knapp-USGS)
W70-10230

BASE-FLOW RECESSION CHARACTERISTICS AND SEASONAL LOW-FLOW FREQUENCY CHARACTERISTICS FOR MISSOURI STREAMS,
Geological Survey, Rolla, Mo.
John Skelton.
Missouri Geological Survey and Water Resources, Water Resources Report 25, July 1970. 43 p, 5 fig, 9 ref, 2 append.

Descriptors: *Base flow, *Recession curves, *Frequency analysis, *Missouri, Streamflow forecasting, Water utilization, Duration curves, Depth-area-duration analysis.
Identifiers: Low-flow frequency (Missouri).

This report presents the results of a hydrograph analysis of base-flow recessions and a statistical study of seasonal low-flow information for Missouri streams. Base-flow recession characteristics of 116 continuous and partial-record stations and seasonal low-flow frequency information for 215 continuous and partial-record stations are presented. Base-flow recession characteristics for the growing season (May through October) were determined for average and maximum depletion rates from gaging station hydrographs. Points of transition between storm and base-flow recessions, as determined by the intersection of trend lines through storm and base-flow recession data ranged from 50to 90-percent duration on station flow-duration curves. Seasonal low-flow frequency information was computed from annual June through August minimums to provide low-flow frequency data for the irrigation season. The average ratio of seasonal to annual low-flow frequency events for the 7-day period is about 1.5:1 for the Springfield Plateau, 2.1:1 for the Southeastern Lowlands, 3.2:1 for the Till and Osage Plains, and 1.1:1 for the Salem Plateau. (Knapp-USGS)
W70-10235

THE HYDROLOGY OF FOUR STREAMS IN WESTERN WASHINGTON AS RELATED TO SEVERAL PACIFIC SALMON SPECIES,
Geological Survey, Tacoma, Wash.
M. R. Collings, Ronald W. Smith, and G. T. Higgins.
US Geological Survey Open-file Report 1970. 158 p, 75 fig, 16 tab, 14 ref.

Descriptors: *Streamflow, *Salmon, *Spawning, *Fish conservation, *Washington, Water conservation, Anadromous fish, Commercial fishing, Sport fishing, Aquatic habitats, Environment, Ecology.
Identifiers: Salmon conservation.

Enhancement or even preservation of the Pacific Salmon hinges on the careful planning and proper management of the streamflow upon which they depend for spawning purposes. A method of determining preferred spawning conditions and the results of the investigation of 129 measurements on 14 study reaches of the Dewatto, Cedar, Kalama, and North Fork Nooksack Rivers are presented. Water depth and velocities were measured to designate, from area- (spawnable) discharge curves, peak preferred spawning flows for fall chinook, spring chinook, sockeye, and coho salmon at each reach on each river. Also, streambed gravels, water temperature, suspended sediment, dissolved oxygen, and specific conductance are used to help evaluate river conditions during spawning. Peak spawning discharges ranged, for the four salmon species on each of the three study reaches of each river, from 50 to 140 cfs (cubic feet per second) on Dewatto River, from 230 to 510 cfs on Cedar River, from 245 to 800 cfs on Kalama River, and from 195 to 710 cfs on North Fork Noosack River. (Knapp-USGS)
W70-10240

ESTIMATED MEAN-ANNUAL RUNOFF AT POST HEADQUARTERS AREA, WHITE SANDS MISSILE RANGE, NEW MEXICO,
Geological Survey, Albuquerque, N. Mex.
Arthur G. Scott.
US Geological Survey Open-file report, July 1970. 13 p, 3 fig.

Descriptors: *Runoff, *Stream gages, *New Mexico, *Regression analysis, Statistical methods, Water yield, Rainfall-runoff relationships, Water resources development, Water supply.
Identifiers: White Sands Missile Range (N Mex).

Three different methods of estimating long-term mean-annual runoff were tried in the White Sands Missile Range Headquarters area. Two were considered unsuccessful--a channel geometry method, and a precipitation-altitude relation. Calculations of runoff based on the graphical regression of annual precipitation against annual runoff results in the best estimate possible with the data available. Mean-annual runoff in the drainage area of about 81 square miles is about 69 acre-feet. The standard error for this calculation, based on eight station-years of record, is about 12 percent. An additional error is introduced by projecting data from gaged sites to ungaged sites. The estimated mean-annual runoff value can be better defined and the error reduced by gaging other sites in the Post Headquarters area and by the use of longer periods of record. (Knapp-USGS)
W70-10241

WATER RESOURCES OF THE REDWOOD RIVER WATERSHED, SOUTHWESTERN MINNESOTA,
Geological Survey, Washington, D.C.
W. A. Van Voast, L. A. Jerabek, and R. P. Novitzki
For sale by US Geological Survey, Washington, DC. Price $1.75 per set. US Geological Survey Hydrologic Investigations Atlas HA-345, 3 sheets, 1970. Text, 35 fig, 5 tab, 8 ref.

Descriptors: *Water resources, *Minnesota, Surface waters, Groundwater, Water quality, Recreation, Municipal water, Irrigation water, Water resources development, Lakes, Streamflow, Floods, Aquifers.
Identifiers: Redwood River (Minn).

The water resources of the Redwood River watershed, Minnesota are described in a 3-sheet hydrologic atlas consisting of maps, geologic cross sections, block diagrams, graphs, and tables. Total water use in the watershed is less than 5 percent of the average flow of the Redwood River at Redwood Falls. Over 90 percent of the withdrawals are from groundwater sources. There is good potential for developing both ground- and surface-water sources to meet several times the current demands. Municipal supplies in the watershed are from groundwater. Most municipalities would have little trouble increasing supplies by drilling additional wells. However, water is hard to very hard and generally exceeds the recommended limits for iron and manganese. The suitability of water from a particular source depends upon the intended use. Factors contributing to the desirability of certain waters include the quantity available, the accessibility of the source, and the physical and chemical characteristics of the water. (Knapp-USGS)
W70-10253

HYDROLOGIC RECONNAISSANCE OF THE TANANA BASIN, CENTRAL ALASKA,
Geological Survey, Washington, D.C.
G. S. Anderson.
For sale by U S Geological Survey, Washington, D C - Price $2.00 per set. U S Geological Survey Hydrologic Investigations Atlas HA-319, 4 sheets, 1970. Text, 20 fig, 4 map, 7 tab, 46 ref.

Descriptors: *Hydrogeology, *Water resources, *Alaska, Permafrost, Groundwater, Surface waters, Streamflow, Aquifers, Water yield, Water resources development, Glaciers, Freezing, Runoff, Discharge (Water), Water quality.
Identifiers: Tanana Basin (Alaska).

The Tanana basin in interior Alaska covers approximately 44,500 square miles with 576 square miles of its headwaters in Canada. This report is intended to define in broad terms the hydrology of the Tanana basin. Although basic data are limited, sufficient information is available to formulate a framework for further collection of basic data, preliminary development planning, and identification of problems. The Tanana basin is entirely within the discontinuous permafrost zone of Alaska. Groundwater in the Tanana basin occurs under unconfined and artesian conditions. Unconfined groundwater generally is found in unconsolidated alluvium in the valleys and in fractured bedrock beneath high slopes and ridges. Artesian conditions generally occur in the lower slopes where permeable beds are confined by permafrost or by impermeable sedimentary beds. Along the lower hillslopes, flowing artesian wells are common. The thermal effects of water exert a dominant control on the permafrost regimen. Deeper lakes and rivers and the circulation of groundwater cause the degradation of permafrost and limit its distribution both vertically and areally. The average streamflow of the Tanana River near its mouth is estimated as 37,000 cfs. Approximately 85% of this discharge originates in the Alaska Range; approximately 50% of the discharge is contributed by 4 tributaries from the south side, the Kantishna, Nenana, Nabesna, and Delta Rivers. (Knapp-USGS)
W70-10254

BOUNDARY SHEAR STRESS IN RIVERS AND ESTUARIES,
Washington Univ., Seattle. Dept. of Civil Engineering.
Ronald E. Nece, and J. Dungan Smith.
ASCE Proceedings, Journal of the Waterways and Harbors Division, Vol 96, No WW 2, Paper 7280, p 335-358, May 1970. 36 p, 13 fig, 1 tab, 18 ref. 2 append. USAEC Contract AT (45-1)-1752.

Descriptors: *Shear drag, *Boundary process*Rivers, *Estuaries, *Current meters, Open chanel flow, Instrumentation, Shear, Turbulent flo Velocity.
Identifiers: Boundary shear stress, Preston tubes.

A Preston tube and an array of miniature curre meters for use in rivers and estuaries are describe Procedures are presented for making a Prest tube determination of boundary shear stress hydraulically smooth, transitional, and rough s faces in such natural waterways. Limited fi results available appear to substantiate the metho (Knapp-USGS)
W70-10257

AN ASSESSMENT OF THE WAVE AGITATIO IN THE SMALL BOAT BASIN AT TI CANADA CENTRE FOR INLAND WATERS,
Department of Energy, Mines and Resources, tawa (Ontario). Inland Waters Branch.
For primary bibliographic entry see Field 02H.
W70-10262

MEKONG DELTA MATHEMATICAL MODE PROGRAM CONSTRUCTION,
Bologna Univ. (Italy); and Societe Grenoblo d'Etude et d'Applications Hydrauliques (France)
For primary bibliographic entry see Field 04A.
W70-10264

USE OF ISOTOPIC DECAY RATES IN TURB LENT DISPERSION STUDIES,
Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 05B.
W70-10268

CITY OF BIRMINGHAM V NICHOLS (A CELERATED EROSION OF RAVINE E CAVATED BY CITY).

1 So 2d 5-6 (Ala 1941).

Descriptors: *Alabama, *Drainage programs, *S tlement (Structure), *Accelerated erosion, Adju cation procedure, Damages, Water injury, Judic decisions, Legal aspects, Drainage practices, Sto drains, Drainage systems, Excess water (Soil Riddance (Legal aspects), Surface runoff, Chan improvement, Storm runoff, Bank erosion, Gu erosion, Road damage, Gullies, Flow augmen tion.

Plaintiff's house and store were bordered by a na ral ravine which drained the upland. The house a foundation were supported by a retaining w along the ravine for the length of the house. Defe dant city dredged, deepened and widened ravine to accelerate water runoff during heavy ra fall. The accelerated onrush of water washed the foundation of plaintiff's house, causing it to s tle. Plaintiff brought action for damages, alleging the pleadings that defendant had extended ravine onto plaintiff's property and removed par his property. This allegation of trespass was supported by evidence presented at trial. Oth evidence presented at trial, however, corroborat plaintiff's assertion of defendant's negligence deepening and widening the ditch. In reversing lower court's decision for plaintiff, the Supre Court of Alabama held that the trial court h committed reversible error in submitting the supported allegation of trespass to the jury. T court noted, however, that municipalities have duty to protect lower proprietors when utiliz natural drains to accelerate runoff of surface wat (Hart-Florida)
W70-10288

ANNOTATED BIBLIOGRAPHY ON HYDROL GY AND SEDIMENTATION 1966-19 UNITED STATES AND CANADA.
Water Resources Council, Washington, D.C.

For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C, 20402 - Price $5.25. Water Resources Council, Joint Hydrology-Sedimentation Committees Bulletin 10, July 1970. 613 p.

Descriptors: *Bibliographies, *Abstracts, *Hydrology, *Sedimentation, Water resources, Water chemistry, Water quality, Groundwater, Surface waters, Hydrogeology, Water utilization, Snow, Runoff, Meteorology, Flow, Floods, Forests, Hydrologic budget.

This bibliography of over 7,000 references is a guide to literature on hydrology and sedimentation for the use of Government agencies and the public. Efforts were made to cover all such literature published in the United States and Canada during 1966-1968. The index of the bibliography covers both place and subject. In the United States and Canada, the smallest geographical subdivisions used are states and provinces. Elsewhere, geographical subdivision is by country. For papers applying to areas larger than the smallest subdivision, entries are listed under major river basins in the United States and by continents for the rest of the world. Secondary listings have been used where a paper is of a scope clearly exceeding the one subject listing. (Knapp-USGS)
W70-10318

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65 - PART 9. COLORADO RIVER BASIN, VOLUME 1. COLORADO RIVER BASIN ABOVE GREEN RIVER.
Geological Survey, Washington, D.C.

For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402. U S Geological Survey Water-Supply Paper 1924, 1970. 488 p, 1 fig, 1 plate.

Descriptors: *Surface waters, *Streamflow, *Flow measurement, *Gaging stations, Flow rates, Average flow, Low flow, Lakes, Reservoir stages.
Identifiers: *Colorado River basin, *Basic data, Stream discharge, Flow extremes, Crest stage.

This volume, Surface Water Supply of the Colorado River Basin Above Green River, is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The data reported comprise a description of the gaging station, and tables showing the daily, monthly, and yearly discharges of the stream. The description of the station gives the location drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. Data for partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. (See also W70-10320) (Woodard-USGS)
W70-10319

SURFACE WATER SUPPLY OF THE UNITED STATES, 1961-65 - PART 8. WESTERN GULF OF MEXICO BASINS, VOLUME 2. BASINS FROM LAVACA RIVER TO RIO GRANDE.
Geological Survey, Washington, D.C.

For sale by Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $4.00. U S Geological Survey Water-Supply Paper 1923, 1970. 786 p, 1 fig, 1 plate.

Descriptors: *Surface waters, *Streamflow, *Flow measurement, *Gaging stations, Flow rates, Average flow, Low flow, Lakes, Reservoir stages.
Identifiers: *Western Gulf of Mexico Basins, Basic data, Stream discharge, Flow extremes, Crest stage.

This volume, Surface Water Supply of Western Gulf of Mexico Basins, Lavaca River to Rio Grande, is one of a series of 37 reports presenting records of stage, discharge, and content of streams, lakes, and reservoirs in the United States during the 1961-65 water years. The data reported comprise a description of the gaging station, and tables showing the daily, monthly, and yearly discharges of the stream. The description of the station gives the location drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. Data for partial-record stations are presented in two tables. The first is a table of discharge measurements at low-flow partial-record stations, and the second is a table of annual maximum stage and discharge at crest-stage stations. (See also W70-10319) (Woodard-USGS)
W70-10320

LAND CAPABILITY: A HYDROLOGIC RESPONSE UNIT IN AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
Charles B. England.
USDA-ARS 41-172, Sept 1970. 12 p, 4 tab, 1 illus, 18 ref.

Descriptors: *Streamflow, *Runoff, *Watersheds (Basins), *Hydrologic properties.
Identifiers: Ralston Creek, Iowa, land capability classes, hydrologic soil grouping.

Understanding the hydrology of agricultural watersheds requires a knowledge of the spatial distribution of runoff-contributing and runoff-absorbing areas and their relation to each other. Soil surveys, interpreted into land-capability groupings, can provide a tool for assessing spatial distribution, and thus appear to offer promise as a serviceable and, fortunately, already established hydrologic soil grouping. Land-capability classes are based on the same soil-landform criteria as those used in hydrologic soil groupings: surface moisture capacities and position on the landscape. In addition, land-capability classes are intuitively unique in land use and provide a basis for futuristic estimates of land use as well as hydrologic performance. This concept is exploratory and is offered here as an inducement for discussion and, hopefully, further testing. (England-USDA-ARS)
W70-10407

FOLKLORE AND BROMIDES IN WATERSHED MANAGEMENT.
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-10410

NICHOLS V CITY OF MORRISTOWN (LIABILITY FOR INJURY DUE TO INADEQUACY OF CREEK TO ACCOMMODATE SURFACE WATER).

263 NW 900-901 (Minn 1935).

Descriptors: *Minnesota, *Surface drainage, *Rainfall-runoff relationships, *Overflow, Cities, Tiles, Tile drains, Tile drainage, Surface waters, Surface runoff, Creeks, Outlets, Rain, Rainfall, Snowmelt, Judicial decisions, Legal aspects, Damages, Remedies.

Plaintiff sought damages for injury to his property caused by the overflow of a creek. Plaintiff contended the overflow was due to the negligent laying of drainage tile by defendant city. Defendant contended the overflow was caused by the fact that the creek could not accommodate the surface water that was produced by melting snow and heavy rains. Based on the testimony and other evidence of record, the court ruled that plaintiff had no cause of action due to any negligent or improper conduct on defendant's part. The judgment for defendant was affirmed. (Price-Florida)
W70-10483

2F. Groundwater

MODEL STUDIES OF TIDAL EFFECTS ON GROUNDWATER HYDRAULICS,
Hawaii Univ., Honolulu. Water Resources Research Center.
John A. Williams, Ronald N. Wada, and Ru-yih Wang.
Available from NTIS as PB-194 353, $3.00 in paper copy, $0.65 in microfiche. Hawaii University Water Resources Research Center Technical Report No 39, May 1970. 80 p, 21 fig, 4 tab, 4 append. OWRR Project A-015-HI (1).

Descriptors: *Tidal effects, *Water level fluctuations, *Model studies, *Groundwater, Groundwater movement, Porous media, Computer programs, Mathematical models, Analog models, Hydraulic models.
Identifiers: Groundwater-tidal relationships.

A model study was made of the propagation of periodic fluctuations in the piezometric head through a saturated porous media. Three different models were employed: a hydraulic model, a mathematical model, and an electrical analog model. The hydraulic model consisted of one or more layers of polyurethene foam placed in a lucite tank. The foam was tested in a confined and unconfined condition using both a no-flow and a constant-head boundary condition at the internal boundary. The mathematical and electric analog models duplicated the conditions in the hydraulic model. The diffusion theory can describe the propagation of such distrubances provided that the boundary conditions are satisfied and that the correct diffusion coefficient is employed. The calculation of the correct diffusion coefficient requires that an appropriate storage coefficient and an apparent porosity be used for the confined and unconfined models, respectively. For the unconfined case, the ratio of the apparent porosity to the true porosity is of the same order of magnitude for both the polyurethene foam and a Sacramento River sand. (Knapp-USGS)
W70-10034

OPTIMAL PLANNING OF A COASTAL COLLECTOR,
Technion-Israel Inst. of Tech., Haifa; and Water Planning for Israel Ltd., Tel-aviv.
M. Shechter, and J. Schwarz.
Research supported by grants from US Dept of Agriculture and TAHAL, Water Planning for Israel. Water Resources Research, Vol 6, No 4, p 1017-1024, August 1970. 8 p, 3 fig, 3 tab, 8 ref.

Descriptors: *Water resources development, *Water yield, *Mathematical models, *Optimization, Water levels, Pumping, Withdrawal, Groundwater movement, Saline water-freshwater interfaces, Saline water intrusion, Hydrogeology.
Identifiers: *Well fields, Israel, Coastal aquifers.

The optimal design of a collector using seaward groundwater flow in a coastal aquifer is obtained by analyzing the interrelated hydrologic, engineering, and economic aspects of the project. The optimal size of the project determines the pumping rate and the pumping policy, as well as the location of the wells in relation to the coast. A model of the relevant hydrologic relationships in the aquifer uses a criterion for economically efficient utilization of the aquifer, estimates the model parameters, and determines an optimal project size. (Knapp-USGS)
W70-10053

APPLICATION OF THE CONVOLUTION RELATION TO ESTIMATING RECHARGE FROM AN EPHEMERAL STREAM,
Arizona Univ., Tucson. Hydrology and Water Resources.
For primary bibliographic entry see Field 02A.
W70-10067

GROUNDWATER LEVELS IN NEBRASKA,
Geological Survey, Lincoln, Nebr.
For primary bibliographic entry see Field 04B.
W70-10071

GENERAL HYDROLOGY OF THE MIDDLE GULF AREA, FLORIDA,
Geological Survey, Tallahassee, Fla.
R. N. Cherry, J. W. Stewart, and J. A. Mann.
Florida Bureau of Geology Report of Investigation No 56, Department of Natural Resources, 1970. 96 p, 45 fig, 4 tab, 34 ref.

Descriptors: *Hydrogeology, *Water resources, *Florida, Hydrologic budget, Groundwater, Surface waters, Springs, Groundwater movement, Streamflow, Aquifers, Water supply, Water utilization.
Identifiers: Middle Gulf Area (Fla).

The Middle Gulf area in the west-central coast of peninsular Florida encompasses about 1,700 sq mi. The area is drained principally by the Crystal, Homosassa, Chassahowitzka, Weekiwachee, Pithlachascotee and Anclote Rivers and Cypress Creek. The average daily discharge from thearea for the period January 1964-June 1966, was 2,300 cfs. No permanent regional declines in surface or groundwater levels have occurred in the area. Principal outflow from the hydrologic system is evapotranspiration which amounts to about 67% of the total outflow. Runoff amounts to about 32% and direct groundwater outflow to the sea is about 1%. Rainfall averages about 55 inches annually. Eighty percent of the runoff from the area originates either as spiringflow or seepage to streams from the Floridan aquifer. The water-level gradients in the system are about the same as the topographic gradients (2-3 ft/mi). Water levels are highest in late summer or early fall following the rainy season and are lowest in late May or early June. The chemical quality of ground and surface water is good. Ample supplies of good quality water are available for existing and foreseeable uses. (Knapp-USGS)
W70-10073

INTERFERENCE BETWEEN GRAVITY WELLS STEADY STATE FLOW,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering.
Abdel-Aziz I. Kashef.
Water Resources Bulletin, Vol 6, No 4, p 617-630, July-August 1970. 14 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Groundwater movement, *Drawdown, *Water level fluctuations, *Steady flow, Dupuit-Forchheimer theory, Mathematical studies, Water table, Porous media, Well spacing.
Identifiers: Well interference.

Under steady state conditions of flow, seepage toward a single gravity well is governed by the Laplace Equation, which may be written in terms of either the hydraulic head, the pressure head, or the velocity potential. Although this equation is linear, the principle of superposition cannot be applied to sum up the individual effects in the case of a multiple gravity well system because of the variation of the flow domain under the effect of one or several wells. A method is presented allowing the use of the superposition principle in a restricted form. Decrements of the base pressure heads are superposed on initial heads before pumping. Decrements in the areas of the pressure head diagrams across specific vertical sections can be summed up. (Knapp-USGS)
W70-10076

HOW MUCH UNDERGROUND WATER STORAGE CAPACITY DOES TEXAS HAVE,
Texas Water Development Board, Austin. Groundwater Div.
For primary bibliographic entry see Field 04B.
W70-10081

SALINE GROUNDWATER RESOURCES OF THE RIO GRANDE DRAINAGE BASIN--A PILOT STUDY.
Geological Survey, Albuquerque, N. Mex.
For primary bibliographic entry see Field 03A.
W70-10086

INVESTIGATION OF GROUNDWATER FLOW WITH RADIOCARBON,
Groningen Rijksuniversiteit (Netherlands).
J. C. Vogel.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/24, p 355-369, 1967. 15 p, 7 fig, 5 tab, 2 ref.

Descriptors: *Groundwater movement, *Radioactive dating, *Carbon radioisotopes, Flow velocity, Recharge, Aquifers, Surface-groundwater relationships, Tracers, Tracking techniques, Stable isotopes, Radioisotopes, Radioactivity techniques.
Identifiers: Netherlands.

Radiocarbon dating of groundwater may be used for deduction of recharge rates of aquifers. The relationships between the age at a point in the water-body and the recharge depends on whether the aquifer is confined or unconfined. For an unconfined aquifer receiving recharge over the whole surface area a simple relationship is deduced. Such an aquifer can be characterized by its age at half-depth. Natural radiocarbon has been used to study flow patterns and flow-rates of subterranean waterbodies in the Netherlands. The deep groundwater in the south-east region of the Usselmeer presents a complicated situation caused by the inhomogeneity of the strata. Flow-rates are therefore not so readily deduced, but the different aquifers can be distinguished by using the isotopes C-14, C-13 and O-18 as natural tracers. In the province of Friesland the deep groundwater shows a more consistent picture with flow times of several thousand years corresponding to quite acceptable flow-rate of around 10 m/yr. (Knapp-USGS)
W70-10092

NATURAL TRITIUM IN GROUNDWATER STUDIES,
Iceland Univ., Reykjavik.
P. Theodorsson.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/26, p 371-380, 1967. 10 p, 7 fig, 1 tab, 6 ref.

Descriptors: *Water chemistry, *Tritium, *Fallout, Radioisotopes, Groundwater movement, Tracers, Tracking techniques, Water analysis, Thermal springs, Thermal water.
Identifiers: Iceland.

Since 1952 large quantities of tritium have been injected into the atmosphere from tests with thermonuclear weapons and large variations in the tritium concentrations of rain have occurred. These variations are reflected in groundwater in different ways depending on the history of the water. Therefore, tritium measurements can give valuable information about groundwater dydrology. Rain, river water, groundwater and geothermal water from various localities in Iceland have been sampled since 1960, and routine measurements of tritium have been carried out since 1963. The paper reports the tritium concentration of thermal water from major geothermal areas in Iceland together with some measurements on other groundwater systems. (Knapp-USGS)
W70-10093

TRITIUM HYDROLOGY IN NEW ZEALAND,
Department of Scientific and Industrial Researc
Lower Hutt (New Zealand). Div. of Nucle
Sciences.
T. L. Grant-Taylor, and C. B. Taylor.
In: Isotopes in Hydrology, Proceedings Symposiu
of International Atomic Energy Agency and Int
national Union Geodesy and Geophysics, Vien
Nov 14-18, 1966: International Atomic Ene
Agency STI/PUB/141, Vienna, Paper No S
83/27, p 381-400, 1967. 20 p, 7 fig, 8 tab, 33 ref.

Descriptors: *Tritium, *Groundwater moveme
*Tracers, Radioactivity techniques, Radioisotop
Tracking techniques, Fallout, Recharge, Aquife
Groundwater basins.
Identifiers: New Zealand.

Knowledge gained from the study of post-th
monuclear concentrations of THO in New Zeala
rainwaters has been applied to the interpretation
the measured concentrations in a number of
derground and surface waters. The Heretaun
Plains artesian system is particularly simple.
geometry allows mathematical expressions to
derived relating the tritium concentrations in w
tapping the main, shallowest aquifer to
distances of these wells from the aquifer input,
terms of the various aquifer parameters. In the H
Valley system, comparison of the concentrations
river and artesian water over a period of some ye
allows an exact determination of aquifer travel ti
to the main withdrawal point. Measuremer
which are in good agreement with geologi
evidence, are reported for waters taken from
ferent levels of a test bore penetrating the differ
strata of the system. (Knapp-USGS)
W70-10094

**TRITIUM AND HYDROGEOLOGY-I
VESTIGATIONS AND MEASUREMENTS CA
RIED OUT AT THE GRENOBLE NUCLE
RESEARCH CENTER (FRENCH),**
Commissariat a l'Energie Atomique, Greno
(France). Centre d'Etudes Nucleares.
For primary bibliographic entry see Field 07A.
W70-10097

**SEASONAL VARIATIONS IN THE TRITIU
CONTENT OF GROUNDWATERS OF T
VIENNA BASIN, AUSTRIA,**
International Atomic Energy Agency, Vie
(Austria).
G. H. Davis, B. R. Payne, T. Dincer, T. Florkows
and T. Gattinger.
In: Isotopes in Hydrology, Proceedings Symposiu
of International Atomic Energy Agency and Int
national Union Geodesy and Geophysics, Vien
Nov 14-18, 1966: International Atomic Ene
Agency STI/PUB/141, Vienna, Paper No S
83/32, p 451-473, 1967. 23 p, 9 fig, 1 tab, 11 ref.

Descriptors: *Tritium, *Groundwater moveme
*Recharge, *Tracers, *Tracking techniqu
Groundwater basins, Radioisotopes, Radioactiv
techniques, Precipitation (Atmospheric), Fallou
Identifiers: Vienna Basin (Austria).

Monthly analyses of tritium from 22 sources
groundwater of the Vienna Basin have been ma
since April 1965 with a view to elucidating
complex groundwater-surface water relations a
ascertaining the movement of groundwaters. T
sources are classified broadly into four groups:
Nonthermal springs including karst springs of
bordering mountains; (2) thermal springs ris
along faults that border the floor of the Vie
Basin; (3) wells on the floor of the Basin; and
large groundwater overflows on the floor of
Basin. All groundwater sampled showed the eff
of local recharge by high tritium precipitation
the exceptionally wet summer of 1965. Grou
water overflows thought to represent dischar
from the main groundwater reservoir w
generally higher in tritium than other groundwat

indicating rapid shallow circulation from nearby streams. Thermal springs believed representative of deep circulation all showed the effect of mixing with shallow waters recharged from current precipitation. The highest tritium contents in well waters were from the upper part of the Basin where water levels are very deep and streams lose water in crossing the alluvium. Samples taken during drilling of a deep exploratory well show a decrease in tritium with depth, but even at 140 m depth the tritium content was 13 T. U. indicating relatively rapid circulation throughout the principal aquifer. (Knapp-USGS)
W70-10098

THE APPLICATION OF RADIATION LOGS TO GROUNDWATER HYDROLOGY,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W70-10099

RADIOISOTOPE TRACERS IN LARGE-SCALE RECHARGE STUDIES OF GROUNDWATER,
Water Planning for Israel Ltd., Tel Aviv (Israel); and Weizmann Inst. of Science, Rehovoth (Israel).
For primary bibliographic entry see Field 07B.
W70-10100

SINGLE-WELL PULSE TECHNIQUE,
Geological Inst., Warsaw (Poland); Federal Experimental and Research Inst., Vienna (Austria); and Institute of Nuclear Research, Krakow (Poland).
For primary bibliographic entry see Field 07B.
W70-10101

INVESTIGATIONS INTO GROUNDWATER BALANCE BY APPLYING RADIOISOTOPE TRACERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 07B.
W70-10102

BOREHOLE DILUTION TECHNIQUES: A CRITICAL REVIEW,
International Atomic Energy Agency, Vienna (Austria); Federal Experimental and Research Inst., Vienna (Austria); and Institute of Nuclear Research, Kracow (Poland).
For primary bibliographic entry see Field 07B.
W70-10103

LABORATORY EVALUATION OF Cr-51 EDTA AS A TRACER FOR GROUNDWATER FLOW,
Chalmers Univ. of Technology, Goteborg (Sweden); and Ingeniors Vetenskaps Akademien, Stockholm (Sweden).
For primary bibliographic entry see Field 07B.
W70-10106

APPLICATION OF THE INTEGRATION METHOD TO THE DETECTION OF WATER-BORNE Cr-51-EDTA AND RADON ON ACTIVATED CARBON (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleares.
For primary bibliographic entry see Field 07B.
W70-10107

FUNDAMENTALS OF THE DISPERSION OF RADIONUCLIDES IN SANDY AQUIFERS,
Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
L. H. Baetsle, and J. Souffriau.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/41, p 617-628, 1967. 12 p, 4 tab, 8 ref.

Descriptors: *Tracers, *Tracking techniques, *Groundwater movement, *Hydrogeology, Aquifers, Sands, Sandstones, Instrumentation, Data processing, Dispersion, Diffusion, Mixing, Velocity, Adsorption.
Identifiers: Tracer dispersion.

Design principles for injections of radioactive trace substances into homogeneous aquifers are outlined. If the radiotracer is not absorbed by the solid phase the pulse shape has a symmetric form that may be described mathematically by the classical diffusion equations. The magnitude of the dispersion coefficients and their determination are discussed in detail. The leading and trailing parts of the distribution curve may be considered as forming part of two different normal distributions with two dispersion coefficients. An example of this approach is out in detail. The asymmetric pulse-shape can be described analytically as a homogeneous concentration/distribution curve, but the computation method is very complicated. Some limitations of this approach are discussed from the fundamental as well as from the computation point of view. (Knapp-USGS)
W70-10109

THE STORAGE COEFFICIENT AS A FUNCTION OF WATER TABLE CELERITY,
Washington State Univ., Pullman. Dept. of Civil Engineering.
David T. Higgins, and Cheng-Nan Lin.
Available from NTIS as PB-194 458, $3.00 in paper copy, $0.65 in microfiche. Completion Report, August 1970. 41 p, 14 fig, 4 tab, 10 ref, 4 append. OWRR Project A-029-WASH (1).

Descriptors: *Storage coefficient, Specific yield, Unsteady flow, Transient flow, *Drainage, *Drawdown, *Water table.

Many analyses of unsteady water table drawdown lead to inaccurate results near the outflow face at early time. They suffer from the assumption that the yield of drainable water is immediate and complete, as is that of confined aquifers. That assumption is true only for slow rates of drawdown. For rapid drawdown a better assumption is required. It is hypothesized that the rate of gravity drainage varies inversely with the rate of water table drawdown. The hypothesis was disproved in tests of vertical sand column drainage. Over the range of variables tested the drainage increased with water table celerity and showed multiple values. The parameter was the rate of pressure drop at the column base. A computer simulation of the problem was devised which closely reproduced the experimental results. Another approach to the problem was taken. For a given rate of change of base pressure the column drainage approaches an asymptotic value. Normalized asymptotic drainage-pressure drop data for several sand sizes plotted as a single curve. A simple exponential equation approaches that function. A modification of this equation is proposed which is based on the similarities between stream tubes in aquifers and the vertical sand column. It is recommended that application of the modification to multidimensional drawdown problems be pursued.
W70-10119

SOUTHERN MARYLAND RECORDS OF SELECTED WELLS, WATER LEVELS, AND CHEMICAL ANALYSES OF WATER,
Geological Survey, Towson, Md.
For primary bibliographic entry see Field 04B.
W70-10231

HYDROGEOLOGIC DATA FOR THE LOWER HOUSATONIC RIVER BASIN, CONNECTICUT,
Geological Survey, Hartford, Conn.
For primary bibliographic entry see Field 04B.
W70-10233

HYDROLOGIC CONDITIONS AND ARTIFICIAL RECHARGE THROUGH A WELL IN THE SALEM HEIGHTS AREA OF SALEM, OREGON,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 04B.
W70-10236

WATER RESOURCES AT MARINE CORPS SUPPLY CENTER, BARSTOW, CALIFORNIA FOR THE 1969 FISCAL YEAR,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 04B.
W70-10237

A DIGITAL MODEL FOR AQUIFER EVALUATION,
Geological Survey, Washington, D.C.
George F. Pinder.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price 35 cents. US Geological Survey Techniques of Water-Resources Investigations, Book 7, Chapter C1, 1970. 18 p, 4 fig, 1 tab, 3 ref.

Descriptors: *Computer programs, *Drawdown, *Aquifers, Data processing, Water level fluctuations, Water levels, Water wells, Withdrawal, Surveys, Testing, Simulation analysis, Synthetic hydrology, Transmissivity, Storage coefficient.
Identifiers: Aquifer evaluation.

A digital computer program simulates the response of a confined aquifer to pumping at a constant rate from one or more wells. The groundwater reservoir may be irregular in shape and nonhomogeneous with infiltration from one or more lakes and streams. The program is written in FORTRAN IV for the IBM 360 system. (Knapp-USGS)
W70-10238

WATER RESOURCES OF NORTHEAST FLORIDA (ST. JOHNS RIVER BASIN AND ADJACENT COASTAL AREAS),
Geological Survey, Tallahassee, Fla.
L. J. Snell, and Warren Anderson.
Florida Bureau of Geology Report of Investigation No 54, Department of Natural Resources, 1970. 77 p, 34 fig, 9 tab, 21 ref.

Descriptors: *Groundwater, *Florida, *Hydrogeology, Water resources, Water resources development, Aquifers, Water wells, Artesian wells, Water levels, Data collections, Hydrologic data.
Identifiers: Groundwater resources, St. Johns River basin (Fla).

This report summarizes and appraises the water resources of the St. Johns River basin and the adjacent narrow coastal strip of northeast Florida. The area contains about 11,200 square miles and has about one-quarter of Florida's population. The report provides information on the occurrence, availability, chemical quality, and use of surface and underground waters as a guide for public and private agencies for planning the most beneficial development of the water resources of the area, to recognize areas of excess and deficient water, areas of good and poor quality waters, and areas where further detailed investigations are desirable. Population growth and economic expansion create the need for additional water supplies either from present sources or from new sources. Ample quantities of good quality water are available to meet foreseeable water needs. Water withdrawn from surface and groundwater sources is less than 10 percent, and that consumed is less than 5 percent of the estimated available supply exclusive of saline waters used for cooling in electric power generation. Most sources of readily available good quality water are in the western parts of the report area and the centers of greatest demand are along the Atlantic coast. (Grossman-USGS)
W70-10239

THEORY OF DISPERSION IN A GRANULAR MEDIUM,
Geological Survey, Washington, D.C.
Akio Ogata.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC 20402 - Price 45 cents. US Geological Survey Professional Paper 411-I, 1970. 34 p, 21 fig, 53 ref.

Descriptors: *Dispersion, *Porous media, Groundwater movement, Water chemistry, Path of pollutants, Adsorption, Mathematical studies, Saline water-freshwater interfaces, Saline water intrusion, Equations, Diffusion, Mass transfer, Mixing.
Identifiers: Dispersion in granular media.

Theoretical aspects of investigations and a few confirmatory laboratory studies of the dispersion process are discussed. The basic assumptions associated with the development of the dispersion equation, based on the applicability of a heuristic expression similar to Fick's law, are described. In general, these assumptions limit its application to a homogeneous medium in which the dispersion process is anisotropic. Several solutions are given for the differential equation that approximates the dispersion process. The equations approximating dispersion in a two-fluid system (salt-fresh water) are also presented. (Knapp-USGS)
W70-10242

EMPIRICAL RELATIONS IN PROPERTIES OF UNCONSOLIDATED QUARTZ SANDS AND SILTS PERTAINING TO WATER FLOW,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia); and Australian Atomic Energy Commission Research Establishment, Lucas Heights.
William A. Wiebenga, W. R. Ellis, and L. Kevi.
Water Resources Research, Vol 6, No 4, p 1154-1161, August 1970. 8 p, 6 fig, 2 tab, 9 ref.

Descriptors: *Groundwater movement, *Dupuit-Forchheimer theory, *Tracers, Hydrogeology, Particle size, Porosity, Radioisotopes, Permeability, Velocity, Flow, Specific yield, Sediments, Aquifers, Laboratory tests, Hydraulic conductivity.
Identifiers: Sorting coefficient.

During a laboratory investigation using radiotracers, empirical formulas were developed to replace the ambiguous or incorrect Dupuit-Forchheimer assumption used in relationships governing the flow of water through porous, unconsolidated materials ranging from clay to coarse sands or fine gravels. The Dupuit-Forchheimer assumption states that the ratio of specific flow rate to average flow velocity is equal to porosity, but it is not specified whether true porosity or void ratio or specific yield, also called effective porosity, is meant. The hydraulic conductivity shows a good correlation with the maximum 10% grain size, and the ratio of specific flow rate to average flow velocity shows good correlation with functions of specific yield and percentile sorting coefficient. From field measurements of specific flow rate and average flow velocity the specific yield can be computed. (Knapp-USGS)
W70-10245

LITHOLOGIC CONTROLS ON THE DEVELOPMENT OF SOLUTION POROSITY IN CARBONATE AQUIFERS,
Pennsylvania State Univ., University Park.
Henry W. Rauch, and William B. White.
Water Resources Research, Vol 6, No 4, p 1175-1192, August 1970. 18 p, 14 fig, 6 tab, 15 ref. OWRR Project A-005-PA.

Descriptors: *Karst, *Pennsylvania, *Porosity, *Water chemistry, *Carbonate rocks, Caves, Geochemistry, Limestones, Dolomite, Drainage effects, Geomorphology, Groundwater movement, Subsurface drainage, Rock properties.
Identifiers: Solution porosity.

Movement of groundwater in maturely karsted limestone aquifers is commonly through solution conduits of considerable size. The volume of all accessible caves more than 100 feet in length in the Nittany Valley area of central Pennsylvania was measured. Most caves are entirely within limestones. Cave development in dolomite is extremely rare. Within the limestone sequence the bulk of the cave volume is concentrated in a few members. Chemical and petrographic analyses of the carbonate rocks were associated with cave volume by bar graphs and components analyses. The more cavernous limestones seem to be those with low amounts of dolomite, clay, and other impurities, and a high micrite grain fraction. Coarse limestones and dolomites are less cavernous. (Knapp-USGS)
W70-10250

GEOLOGY AND GROUNDWATER RESOURCES OF THE GRAND RAPIDS AREA, NORTH-CENTRAL MINNESOTA,
Geological Survey, Washington, D.C.
Edward L. Oakes.
For sale by US Geological Survey, Washington, DC - Price $1.50 per set. US Geological Survey Hydrologic Investigations Atlas HA-322, 2 sheets, 1970. Text, 8 fig, 2 map, 3 tab, 11 ref.

Descriptors: *Water resources, *Hydrogeology, *Minnesota, *Mississippi River basin, Aquifers, Glacial drift, Lakes, Reservoirs, Mississippi River, Water yield, Groundwater movement, Water quality, Permeability, Transmissivity, Geology.
Identifiers: Grand Rapids (Minn).

This 2 sheet Hydrological Atlas is one of a series of studies of geology and groundwater availability conducted in and near selected communities on the Mesabi Iron Range, north-central and northeastern Minnesota. This report describes the geology and groundwater conditions in the 303 square-mile Grand Rapids area. Sheet 1 is designed for use by anyone interested in the geology and occurrence of groundwater in the geologic units of the area. Sheet 2 is designed to be used by hydrologists and engineers who have the responsibility for major groundwater development in the area. The Grand Rapids area is drained by the Mississippi and Prairie Rivers. Pokegama Lake is a reservoir formed by a dam on the Mississippi River. Prairie Lake is formed by a dam on the Prairie River. The area also contains many natural lakes and swamps which provide excellent fish and wildlife habitat. Groundwater supplies may be obtained from glacial drift and from Precambrian metasedimentary (Animikie) rocks. The best source of groundwater is from buried outwash in the glacial drift. Regional groundwater movement is toward the Mississippi and Prairie Rivers. Groundwater may be very hard and high in iron and manganese. (Knapp-USGS)
W70-10252

WATER RESOURCES OF THE REDWOOD RIVER WATERSHED, SOUTHWESTERN MINNESOTA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-10253

HYDROLOGIC RECONNAISSANCE OF THE TANANA BASIN, CENTRAL ALASKA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-10254

GROUNDWATER GEOLOGY OF THE ROCK ISLAND, MONMOUTH, GALESBURG, AND KEWANEE AREA, ILLINOIS,
Illinois State Geological Survey, Urbana.
John E. Brueckmann, and Robert E. Bergstrom.
Illinois Geological Survey Report of Investigations 221, 1968. 56 p, 14 fig, 3 tab, 44 ref, append.

Descriptors: *Hydrogeology, *Illinois, Groundwater, Water resources, Water resources development, Water wells, Aquifers, Water utilization, Groundwater movement, Water yield, Water quality, Data collections, Hydrologic data, Geology, Mississippi River basin.
Identifiers: Rock Island (Ill).

Groundwater in the Rock Island, Monmouth, Galesburg, and Kewanee area, Illinois, is obtained from (1) sand and gravel aquifers within the glacial drift; (2) shallow bedrock aquifers that are primarily dolomite of the Niagaran Series (Silurian) and the Keokuk-Burlington Limestone (Mississippian); and (3) deep bedrock aquifers, primarily the Ordovician Ancell Group (Glenwood-St. Peter Sandstone) and the Cambrian Ironton-Galesville Sandstone. Most private water supplies are obtained from the shallow bedrock aquifers, whereas the larger municipal supplies generally are obtained from the deep bedrock aquifers. Sand and gravel aquifers are sparsely distributed in the area. The estimated total pumpage of groundwater alone is 16,531,000 gallons per day for the area. This constitutes about 50% of the estimated total pumpage of both surface and groundwater and serves about 63% of the population. Municipalities now using groundwater can probably develop additional groundwater sources to meet increased demands in the future. (Knapp-USGS)
W70-10284

ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION 1966-1968 UNITED STATES AND CANADA.
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-10318

2G. Water in Soils

FLOW FROM A SPHERICAL SOURCE WITH WATER CONTENT DEPENDENT DIFFUSIVITY,
San Jose State Coll., Calif.
For primary bibliographic entry see Field 05B.
W70-10058

USE OF THE MASS BALANCE METHOD FOR EXAMINING THE ROLE OF SOILS IN CONTROLLING WATERSHED PERFORMANCE,
Agricultural Research Service, University Park, Pa. Northeast Watershed Research Center.
For primary bibliographic entry see Field 02A.
W70-10064

MEASUREMENT OF THE MOLECULAR SIZE OF A SODIUM HUMATE FRACTION,
Geological Survey, Denver, Colo.
R. L. Wershaw, S. J. Heller, and D. J. Pinckney.
Advances in X-Ray Analysis, Vol 13, p 609-61 1970. 9 p, 2 fig, 11 ref.

Descriptors: *Humic acids, *X-ray analysis, *Particle size, *Molecular structure, Soil chemistry, Soil physical properties, Soil chemical properties.
Identifiers: Sodium humate, Molecular size.

As a first step in developing a soil humate classification system a fraction of sodium humate from a North Carolina soil was isolated and its molecular size was measured by small angle x-ray scattering. Most of the sodium humate fractions isolated by ion exchange and gel permeation chromatography have distinctly different infrared absorption spectra, which indicates that these fractions differ from one another in either their chemical structure or degree of polymerizations. Size measurements of one of these fractions by small angle x-ray scattering indicates that the fraction is made up either of molecules of two different sizes or of zones of molecules of a single size. (Knapp-USGS)
W70-10074

VESTIGATIONS INTO GROUNDWATER ALANCE BY APPLYING RADIOISOTOPE RACERS,
esearch Inst. for Water Resources Development, idapest (Hungary).
r primary bibliographic entry see Field 07B.
70-10102

OIL-WATER MOVEMENT AND VAPOTRANSPIRATION: CHANGES IN THE OTOPIC COMPOSITION OF THE WATER,
eidelberg Univ. (West Germany). Physikalisches stitut (II).
r primary bibliographic entry see Field 02K.
70-10104

OCALIZATION OF LEAKAGES FROM A ARGE RESERVOIR, USING RADIOACTIVE RACERS (FRENCH),
ommissariat a l'Energie Atomique, Grenoble rance). Centre d'Etudes Nucleares.
r primary bibliographic entry see Field 07B.
70-10110

ETHODS OF DETERMINATION OF WATER MATERIALS OF DIFFERENT STATE OF GGREGATION (IN RUSSIAN),
emico-Technological Inst., Moscow (USSR).
A. Drozdov, A. P. Kreshkov, and S. I. Petrov.
pekhi Khimii, Vol 38, No 1, p 113-141, 1969.
5 ref.

escriptors: *Hydrology, *Moisture content, quifers, Hydrologic data, Analysis, Earth-water erfaces, Measurement, Drying, Gas chromatography, Distillation, Sorption, Specific gravity, hesion, Conductivity, Chromotography, Absrption, Centrifugation, Radio waves, Nuclear gnetic resonance.
entifiers: NMR Spectroscopy, Coulombometry, trasonic analyses, Titration, Dielectric penetrarity, Gases, Organic liquids, Hydrophotography, tical properties, Beta and gamma emanations.

is essay reviews most important information perent to nearly all methods of water determination materials of highly diversified origin. The paper subdivided into 3 sections: (1) Methods based on pelling water (by drying, sorption, or distillan); (2) Methods ufilizing chemical reactions asometry, titration); (3) Physical and physicoemical methods (determination of specific gravi, cohesion, the rotation angle of polarized light, efficient of refraction, dielectric penetrability, nductance, amount of absorbed coulombs, opti properties, nuclear magnetic resonance (NMR ectrography), gases and organic liquids (absorpn and gas-liquid chromatography), beta and mma emanations, ultrasonic values, restoration film color (hydrophotography), results of centuging, and absorption of radio waves. The volunous list of references, truly international in ope, deserves particular mention. (Wildeisconsin)
70-10168

OVEMENT AND STORAGE OF WATER IN ORTH CAROLINA SOILS,
orth Carolina State Univ., Raleigh. Dept. of Soil ience.
Fulton Lutz.
vailable from NTIS as PB-194 531, $3.00 in per copy, $0.65 in microfiche. North Carolina ate University Soil Information Series No 15, oril 1970. 29 p. OWRR Project No A-008-NC).

escriptors: *Soil water movement, *Soil physical operties, *North Carolina, Bulk density, Hydrau- conductivity, Permeability, Porosity, Storage pacity, Infiltration, Percolation.
entifiers: Coastal plain soils, Mountain soils, edmont soils.

The most important soil physical properties affecting the movement and storage of water in soils are given, including analyses for bulk density, total porosity, pore-size distribution, total and available water-holding capacity and hydraulic conductivity. Values are given for essentially all of the major soil series in North Carolina representing more than two-thirds of the total land area of the State. The hydraulic conductivity data are important for agricultural and urban uses of soils. Soils with extremely low hydraulic conductivities are unsuitable for septic tank installations because of poor drainage; those with extremely high hydraulic conductivities are unsuitable because of the danger of pollution. Information on the available and unavailable water-holding properties of soils is valuable from an agricultural standpoint, particularly to those who irrigate. Even if the degree of dryness of the soil is not accurately know, a good estimate of the amount of irrigation water needed can be obtained. (Grossman-USGS)
W70-10225

EMPIRICAL RELATIONS IN PROPERTIES OF UNCONSOLIDATED QUARTZ SANDS AND SILTS PERTAINING TO WATER FLOW,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia); and Australian Atomic Energy Commission Research Establishment, Lucas Heights.
For primary bibliographic entry see Field 02F.
W70-10245

POST-IRRIGATION MOVEMENT OF SOIL WATER 2. SIMULTANEOUS REDISTRIBUTION AND EVAPORATION,
Wisconsin Univ., Madison.
W. R. Gardner, D. Hillel, and Y. Benyamini.
Water Resources Research, Vol 6, no 4, p 1148-1153, August 1970. 6 p, 6 fig, 9 ref. USDA Grant FG-Is-163.

Descriptors: *Soil water movement, *Evaporation, *Percolation, *Irrigation water, *Evaporation control, Water conservation, Nuclear moisture meters, Soil moisture meters, Laboratory tests, Evapotranspiration.
Identifiers: Soil water redistribution.

Water content measurements by gamma-ray attenuation were made on soil columns during simultaneous redistribution and evaporation following irrigation. Redistribution is shown to reduce evaporation, in some cases appreciably. For a deep irrigation the redistribution proceeds at a rate that is relatively independent of the evaporation process, as has been predicted from numerical solutions of the flow equation. Expressions are derived for obtaining an estimate of amount of reduction in evaporation due to redistribution when the redistribution rate is known. (Knapp-USGS)
W70-10247

REVIEW OF COLLAPSING SOILS,
California State Coll., Long Beach. Dept. of Civil Engineering.
John H. Dudley.
ASCE Proceedings, Journal of the Soil Mechanics and Foundations Division, Vol 96, No SM 3, Paper 7278, p 925-947, May 1970. 23 p, 14 fig, 3 tab, 43 ref.

Descriptors: *Soil compaction, *Soil water movement, *Consolidation, *Subsidence, Soil mechanics, Soil physical properties, Soil structure, Wetting, Moisture content, Moisture tension.
Identifiers: Collapsing soils.

Soils which collapse (undergo large consolidation) when unusual amounts of water are added to them exist in many places around the world. Contrary to the ideas of many observers these collapsing soils derive from many different soil forming processes. Although surface collapse of 15 ft has occurred, the usual amount is considerably less. These soils are of open structure and exist in nature at less than 100% saturation. The major soil materials are silt, sand, or gravel or any of their combinations. Water in tension is the general binding material. A small amount of clay is present in many cases. Other binding agents sometimes contribute. The amount and rate of collapse is a function of grain shape, grain size, existing moisture content, kinds and amounts of clay present, void ratio, adsorbed ions, etc. Maximum collapse occurs at optimum clay content (10% in one case) and moisture content (between 13% and 39%). Most of the collapse can occur before the soil reaches 100% saturation. Estimates of the magnitude of possible collapse derived from routine tests generally are compared to field results. (Knapp-USGS)
W70-10256

HYDROGEN BONDING AND POLYWATER IN CLAY-WATER SYSTEMS,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 01A.
W70-10278

GENESIS OF CARBONATE PAN IN ARID REGION OF RAJASTHAN,
Central Arid Zone Research Institute, Jodhpur (India).
B. B. Roy, P. C. Chatterji, and S. Pandey.
Annals of Arid Zone, Vol 8, No 2, p 181-187, September 1970. 4 fig, 12 ref.

Descriptors: *Carbonates, *Hardpan, *Soil moisture, *Caliche, *Soil profiles, Soil chemistry, Magnesium, Calcium, Impervious soils, Soil types, Soil density, Subsoil, Geology, Geomorphology, Arid lands, Sands.
Identifiers: *India, *Thar Desert, *Pans.

The carbonate or 'kankar' pan occurs in all deserts of the world, usually concealed some distance under the sand. Several theories of pan formation are reviewed and discussed. A small area of the Rajasthan Desert was investigated, relating soil profiles, pan depth, vegetation, geology, geomorphology, and moisture conditions. Rock weathering, followed by release of Ca and Mg due to the action of carbonic acid in infiltrating rainwater, and formation of precipitated carbonates lead to a sub-surface cementation. Thickness of the Rajasthan pans indicates a very long geological past. The soils above the pan are all transported and therefore do not contribute to the formation of the thick zones. Groundwater in pan regions is saline, which, combined with their impervious structure, severely limits cultivation potential. These conditions and the sparseness of existing vegetation, in turn, enhance environmental aridity. (Casey-Arizona)
W70-10293

NATURAL CONDITIONS IN THE SOUTHERN PART OF THE CASPIAN SEMIDESERT,
A. G. Doskach.
Trans. from Russian. In: Genesis and Classification of Semidesert Soils. Israel Scientific Publications, p 2-20, 1968. Translated for the National Science Foundation and the U.S. Department of Agriculture by the Israel Program for Scientific Publications.

Descriptors: *Semiarid climates, *Climatology, *Geographical regions, *Geomorphology, Geology, Alluvial channels, Quaternary period, Tertiary period, Sediments, Clays, Soils, Geologic time, Water resources, Flood plains, Dry seasons, Wet seasons, Petrography, Rivers, Sands.
Identifiers: *Soviet Union, *Caspian Semidesert, *Paleogeography, *Tectonic uplift, Interfluves, Terrigenous materials, Fluvia.

The Caspian semidesert is a sea level plain with vast waterless expanses, lying to the north of the Caspian Sea. Total annual solar radiation is 115-120 calories per square centimeter. Mean annual precipitation is 160-175 millimeters, while

evaporability, due to dry summer winds, reaches 1000 millimeters. Spring, from late March to May, is characterized by very low rainfall, luxuriant ephemeral flowering and snow melts which effect groundwater recharge. Summer lasts through October and is very hot and dry with frequent winds and sporadic rainfall. Steady rainfall occurs in autumn and winter is freezing with a usually persistent snow blanket. Geologically, the area is part of the Caspian tectonic depression and there is a prevalence of marine or lacustrine-marine environments interrupted by relatively short terrigenous phases. Areal geomorphology is a result of a history of periodic changes in Caspian Sea volume and large discharge fluctuations in the ancient Volga and Ural rivers. The southern semidesert is divided into 10 discernable natural physicogeographical regions, and their geology and geomorphology are described in detail. (Casey-Arizona)
W70-10301

NATURAL FREEZING AND THAWING IN A SILT AND A SAND.
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02C.
W70-10411

INTERPRETING NEUTRON PROBE READINGS IN FROZEN SOIL.
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 07B.
W70-10412

SOIL WATER MOVEMENT AS AFFECTED BY DEEP FREEZING,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
Soil Sci Soc Amer Proc Vol 33, No 3, p 333-337, May-June 1969.

Descriptors: *Soil water movement, *Frozen soils, *Gravitational water, *Hydrologic properties, *Infiltration, Moisture content, Percolating water, Permeability, Soil physics, Wisconsin.
Identifiers: Interflow.

Knowledge of water movement into and through frozen soils is needed for studying the hydrologic behavior of northern watersheds. Soil water was logged by the neutron method in both sandy and silty soils over four winters in southwestern Wisconsin. Bonded frost depth, which ranged from 8 to 120 cm at maximum penetration, was measured concurrently by frost probe or resistance blocks. Changes in soil water took place throughout much of the frost season, even with deep soil frost. One series of data showed that water may infiltrate and percolate through more than 60 cm of hard-frozen ground. However, frozen ground did impede percolation, causing a buildup of water in the frozen zone during spring melt. Although neutron readings increased at upper levels during the frost season, most of the increases could not be accounted for by decreases at lower levels. Thus, they appeared to result more from infiltration than from upward migration as reported by others. (Sartz-Forest Service)
W70-10414

WATER STORAGE AND RELATED PHYSICAL CHARACTERISTICS OF FOUR MINERAL SOILS IN NORTH CENTRAL MINNESOTA,
Forest Service (USDA), Grand Rapids, Minn. North Central Forest Experiment Station.
E. S. Verry.
USDA Forest Serv Res Note NC-78, 1969, 4 p, 4 tab, 2 ref.

Descriptors: *Water storage, *Soil water, *Soil types, *Minnesota, *Storage capacity, Mineralogy, Porosity, Soil surveys, Data collections.
Identifiers: Itasca County (Minn).

Soil water storage in 7.5 foot profile varied nearly 100 percent (7.9 to 15.5 inches) among four mineral soils ranging from a sand to sandy loam. Bulk density, size fractions, and four water retention values are tabulated for each horizon. (Verry-Forest Service)
W70-10426

2H. Lakes

EVOLUTION OF TRITIUM ACTIVITY IN THE SOUTH-WEST OF FRANCE (FRENCH),
Institute of Geology of the Aquitaine Basin, Bordeaux (France). Faculty of Sciences.
P. Leveque, M. Vigneaux, and J. Alvinerie.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/30, p 417-432, 1967. 16 p, 7 fig, 1 tab, 12 ref.

Descriptors: *Tritium, *Lakes, *Rain, *Groundwater, *Fallout, Water chemistry, Radioisotopes, Tracers, Clays, Sampling, Data collections, Hydrologic data.
Identifiers: France.

The tritium activity of rain, lake and underground waters has been under investigation in the Bordeaux area (south-west France) since 1964. The 250 or so analyses carried out show that changes in activity of rain water vary rather considerably, with a fairly marked over-all decrease over the period of about 30 months during which observations have been in progress. One of the lakes in the dunes along the coast of Aquitaine, Lake Cazaux, represents a special case by virtue of its hydrological and hydrodynamic features. The fact that this lake, with an area of about 60 sq km, has no notable source of supply other than precipitation makes it a seasonable integrator of the wide variations in the level of tritium activity in rainwater. A comparison with other lakes seems to confirm this hypothesis. There is a considerable lapse of time before periods of maximum rainfall are followed by an increase in the activity of surface water layers. The mean activities of some plants are similar to those found in the water of clays and the lake waters. (Knapp-USGS)
W70-10096

THE FLOW OF A STREAM THROUGH A RESERVOIR,
Gemeinnutziges Institut, Duesseldorf (West Germany).
For primary bibliographic entry see Field 02E.
W70-10111

INTERNAL CURRENTS RESULTING FROM INTERMEDIATE DENSITY INFLOWS INTO STRATIFIED RESERVOIRS,
Washington Univ., Seattle. Charles W. Harris Hydraulics Lab.
For primary bibliographic entry see Field 02E.
W70-10121

DIEL VERTICAL MOVEMENTS AND FEEDING OF UNDERYEARLING SOCKEYE SALMON AND THE LIMNETIC ZOOPLANKTON IN BABINE LAKE, BRITISH COLUMBIA,
Fisheries Research Board, Nanaimo (British Columbia). Biological Station.
David W. Narver.
Journal of the Fisheries Research Board of Canada, Vol 27, No 2, p 281-316, 1970. 17 fig, 4 tab, 19 ref.

Descriptors: *Diurnal, *Movement, *Sockeye salmon, *Limnology, *Zooplankton, Seasonal, Depth, Thermocline, Epilimnion, Copepods, Daphnia, Sampling, Nets, Trout, Trawling, Temperature, Light intensity, Diptera, Alaska, Fish, On-site data collections.
Identifiers: *Vertical distribution, *Feeding habits, Diel vertical movement, Juvenile sockeye salmon, Babine Lake (Canada), Bosmina coregc Heterocope septentrionalis, Daphnia longispi Echo-sounder technique, Salmo gairdneri, Pu seine, Diaptomus ashlandi, Chironomid.

A precise diel vertical movement of underyearl sockeye salmon was observed in Babine La (British Columbia). During early July to S tember, at about 1.5 hours after sunrise to hours before sunset, the young sockeye were in distinct layers at approximately 20 and 35 met each layer about 6 meters thick. About 1.5 ho before sunset the two layers began to ascend. 0.5 hour after sunset all fish were within 3 meter the surface, and during darkness were disper throughout the top 5-15 meters, with most below the thermocline. Soon after dawn the moved toward the lake surface, then descen rapidly to daytime depths. By early October behavior pattern changed and was temporally sociated with epilimnion cooling and decrease feeding intensity. Of zooplankton, only Bosm coregoni and Heterocope septentrionalis displa pronounced diel vertical movements. Bosmina habited surface waters during the day and w found most abundant at 12-21 meters at nig Heterocope inhabited the 21-30 meter depths d ing the day and surfaced at night. Young sock fed intensively in the evening near the surface at dawn prior to descent. (Jones-Wisconsin)
W70-10159

GROWTH OF PHYTOPLANKTON A VASCULAR AQUATIC PLANTS AT D FERENT NUTRIENT LEVELS,
Cornell Univ., Ithaca. Dept. of Botany.
H. F. Mulligan, and A. Baranowski.
Verhandlungen der Internationalen Vereinig fur Theoretische und Angewandte Limnologie, 17, p 802-810, 1969. 8 tab, 6 ref.

Descriptors: *Plant growth, *Phytoplankt *Aquatic plants, *Nutrients, Phosphorus, I ganic compounds, Nitrogen, Biomass, Sands, ygen, Alkalinity, Hydrogen ion concentration, bidity, Chlorophyll, Seston, Benthic fl Chlorophyceae.
Identifiers: *Vascular plants, Elodea canade Potamogeton crispus, Myriophyllum spicatum.

Greenhouse experiments to determine opti levels of organic nitrogen and phosphorus aquatic plant growth were conducted as basis establishing eutrophic conditions in ponds. Vari formulations, levels, and ratios of inorg nitrogen and phosphorus were applied to cultu of aquatic vascular plants (Myriophyllum spica var exalbescens, Potamogeton crispus and Elo canadensis) and freshwater phytoplankton pop tions (mostly Chlorophyceae) established in containing natural soil and water. Nutrient le applied ranged from 0.005 to 50 milligrams/ nitrogen and 0.005 to 5.0 milligrams/ phosphorus. The yields of experimental plants a five weeks growth were used as response indi Highest nutrient levels produced the phytoplankton growth while the lower le resulted in higher vascular plant yields. Filam tous algae grew best at intermediate nutrient le High yields of vascular plants never coincided large phytoplankton populations. At the hig nutrient levels, no vascular plant growth occur Of two inorganic phosphorus compounds ev ated, super-phosphate of lime produced the gre yields. Smaller differences were apparent am three inorganic nitrogen compounds. These suggest that future uncontrolled enrichment natural bodies of water will result in growth larger populations of phytoplankton at the expe of benthic macrophytes. (Jones-Wisconsin)
W70-10160

BLUE-GREEN ALGAL BLOOMS SASKATCHEWAN LAKES,
Saskatchewan Univ., Saskatoon.
U. T. Hammer.

Verhandlungen Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 116t125, 1969. 3 fig, 3 tab, 29 ref.

Descriptors: *Cyanophyta, *Lakes, Temperature, Phosphates, Sampling, Seasonal, Diatoms, Eutrophication, Nitrates, Sewage, Physiocochemical properties, Nutrients, Depth, Chemical properties, On-site investigations.
Identifiers: *Water blooms, *Blue-green algae, Saskatchewan (Canada), Morphometry, Qu'Appelle River (Canada), Asterionella formosa, Anabaena flos-aquae, Aphanizomenon flos-aquae, Stephanodiscus, Microcystis aeruginosa, Oscillatoria prolifica, Fragilaria, Ceratium hirundinella.

An attempt was made to establish the relationship of bloom-forming blue-green algae with various physical, chemical, and biological components of lake environments in southern Saskatchewan, emphasizing effects of water temperature and orthophosphate levels on the production of blue-green algae blooms. The nutrient levels clearly place the Qu'Appelle River lakes in the eutrophic category, however application of algal indicators is questionable. Clearly both water temperature and orthophosphate concentrations play important roles in determining the predominance of the kinds of blue-green algal species together with the extent of production of individual species. Other factors undoubtedly also play important roles, such as the mean depth of the lake and consequently the amount of mixing of bottom materials with the main water mass. This may, in fact, involve the organic materials which have been considered important to blue-green production. That these are not strictly necessary was demonstrated with Aphanizomenon. Anabaena flos-aquae had been grown in fresh water medium with inorganics only present. However, it appears likely that proximity with water churned up from the bottom by constant winds does have a beneficial effect on algal growth. (Jones-Wisconsin)
W70-10165

THE UTILIZATION OF FOOD BY THE ZOOPLANKTON FOR ITS GROWTH (IN RUSSIAN),
N. M. Kryuchkova.
Zhurnal Obshchei Biologii, Vol 30, No 4, p 418-425, 1969. 2 fig, 1 tab, 34 ref.

Descriptors: *Zooplankton, *Lakes, *Food chains, Aquatic populations, Foods, Growth rates, Environmental effects, Metabolism, Algae, Daphnia, Copepods, Food webs, Aquatic animals, Laboratory tests.
Identifiers: *Growth utilization coefficients, Food assimilation, Food consumption.

Solution of many problems pertinent to the biological cycle of water basins requires the knowledge of values characterizing the consumption of food by aquatic animals and utilization of consumed food in the processes of growth. A survey of related literature has indicated that the average coefficient of the growth utilization of consumed food (K-sub-1) for freshwater zooplankton is 21.6%, whereas the coefficient of utilization of assimilated food (K-sub-2) is 40%. The same coefficients for marine zooplankton are 25.4% and 39.2%, respectively. The coefficient of food assimilation by both freshwater and marine animals is approximately 60%. These values were obtained in laboratory trials. The species of algae, used as food, not always answered the requirements of the test animals. Therefore, under natural conditions the efficiency of food utilization may be higher than that observed in laboratories. (Wilde-Wisconsin)
W70-10166

MICROBIOLOGICAL PROCESSES OF IRON TRANSFORMATION IN A MEROMICTIC LAKE (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Mikrobiologii.
G. A. Dubinina, and Z. P. Deryugina.
Zhurnal Obshchei Biologii, Vol 30, No 5, p 602-610, 1969. 2 fig, 5 tab, 13 ref.

Descriptors: *Lakes, *Iron, Hypolimnion, Iron bacteria, Oxygenation, Mud, Nutrients.
Identifiers: *Meromictic lakes, *Ferrous iron, Lake Okha-Lampi (USSR), Lake Uzornoye (Western Karelia SSR), Gallionella ferruginea, Hydroxides.

The meromictic Lake Okha-Lampi ('Ornamental') in western Karelia exhibits near its bottom a highly increased concentration of ferrous iron, up to about 100 milliliter/liter. The oxygenated upper part of the iron-enriched zone harbors a very dense population of Gallionella ferruginea and other iron bacteria, comprising 50% to 75% of the entire bacterial population. The diffusion of the hypolimnion iron into the upper strata and its removal from the lake are precluded by bacterial transformation of ferrous compounds into the form of insoluble hydroxides. Consequently, the iron accumulates in mud deposits and benthic water layers. (Wilde-Wisconsin)
W70-10167

THE GENERAL ANALYSIS OF A EUTROPHIC SYSTEM,
Alberta Univ., Edmonton. Dept. of Zoology.
J. R. Nursall.
Verhandlungen Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 109-115, 1969. 2 fig, 2 tab, 18 ref.

Descriptors: *Eutrophication, *Analysis, *Lakes, Cyanophyta, Systems analysis, Physiocochemical properties, Seasonal, Geology, Phytoplankton, Scenedesmus, Antarctic, Thermodynamic behavior, Zooplankton, Biota, Ice, Temperature, Aquatic plants, Euglenophyta, Mysobacteria, Environment, Energy, Indicators, Water pollution effects, Water pollution sources.
Identifiers: Edmonton (Canada), Alberta kettle lakes, Astotin Lake (Canada), Aphanizomenon flos-aquae, Anabaena, Asterionella formosa, Cyclotella meneghiniana, Microcystis aeruginosa, Melosira italica, Nitzschia, Spaherocystis schroeteri, Schizothrix calcicola, Morphometry, Allochthonous material.

An ice-free lake exchanges matter with its environment; covered with ice the lake is a closed system. Major sources of matter for exchange in an open lake system are allochthonous material and organic production by biota; the latter representing a second open system exchanging with the first. The exchange between lake and its environment is unequal; more matter enters the lake from both sources than leaves it, which is the basis of eutrophication. It is enhanced by slowdown of material exchange (or increased rate of accumulation) during the closed period. Since exchange of energy and input of allochthonous material are both independent and unpredictable variables, the nature of the biota also varies unpredictably and contributes its matter inestimably. Biota is opportunistic and variable–predictable only under strongly definable limiting conditions. It follows that the nature and rate of eutrophication is unpredictable nor are biotic indicators reliable, except in special instances of definable rate of constant pollution. Periods of transition between open and closed phases are those of great heat energy loss by a lake system. The variable effects of these periods markedly affect the conditions of the succeeding phases, particularly the closed phase. (Jones-Wisconsin)
W70-10170

MODELING SPREAD OF HEATED WATER OVER LAKE,
Minnesota Univ., Minneapolis. Dept. of Civil Engineering and Hydraulics.
For primary bibliographic entry see Field 05G.
W70-10212

AN ASSESSMENT OF THE WAVE AGITATION IN THE SMALL BOAT BASIN AT THE CANADA CENTRE FOR INLAND WATERS,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
T. M. Dick, and J. Marsalek.
Canada Department Energy, Mines and Resources, Inland Waters Branch Technical Bulletin No 28, 1970. 61 p, 24 fig, 8 tab, 3 ref, append.

Descriptors: *Breakwaters, *Waves (Water), *Harbors, *Lake Ontario, Hydraulic models, Model studies, Coastal engineering, Coastal structures, Marinas.
Identifiers: Hamilton Harbor (Ontario).

The geometry of the small boat basin at the Canada Center for Inland Waters causes multiple reflections of any wave agitation which enters. Consequently, there is a limit to the amount that wave heights can be attenuated by a practical arrangement of additional breakwaters. Hydraulic model studies were made to determine the probability of dangerous wave conditions and the possibility of correcting the problem by constructing breakwaters. The occurrence of undesirable conditions will probably not exceed four days during the navigation season and the best scheme will still require special mooring arrangements for the worst storms. It is recommended that a buoy mooring system be installed but additional breakwaters should not be constructed until further experience is gained. (Knapp-USGS)
W70-10262

TRITIUM IN CRATER LAKE, OREGON,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
For primary bibliographic entry see Field 05B.
W70-10269

STUDIES ON CENTRAL AFRICAN PANS III: FAUNA AND PHYSICO-CHEMICAL ENVIRONMENT OF SOME EPHEMERAL POOLS,
University Coll. of Rhodesia and Nyasaland, Salisbury. Dept. of Zoology.
J. S. Weir.
Hydrobiologia, Vol 33, No 2, p 93-116, 1969. 4 fig, 9 tab, 35 ref.

Descriptors: *Water holes, *Biomass, *Productivity, *Food webs, *Ecology, Arid lands, Precipitation, Aquatic productivity, Secondary productivity, Eutrophication, Frogs, Birds, Fish, Invertebrates, Aquatic animals, Aquatic populations.
Identifiers: *Pans, *Kalahari desert, *Rhodesia, *Tadpoles.

The innumerable small pools and seasonal lakes formed during the rainy season in Central Africa are disappearing because of agriculture and public health control measures. Twelve shallow, representative pans in the Kalahari desert were sampled and analyzed for physico-chemical and biological data when full of water, drying, and dry. Temperatures fluctuated over an 18 degree daily range, and mud was cooler than surface water, offering animals shelter from the thermal stress. Macroscopic fauna from small invertebrates through amphibians were sampled, listed and analyzed for numbers and biomass. Gut content analyses and feeding trials enabled determination of food habits and subsequent construction of hypothetical food webs. Biological productivity was estimated at 2500 kilograms per hectare per year, which compares favorably to the productivity of shallow fish ponds in the same region. Organic matter and pollution were present according to the presence and amounts of animal dung and seasonal vegetation, which in turn determined faunal diversity and biomass. Tadpoles were exteremely numerous and were benthic detritus feeders. Polluted alkaline pools with tadpoles had the greatest biomass. The possibility is discussed of integrating pan productivity into African game ranching programs. (Casey-Arizona)
W70-10296

IN RE BD OF SUPERVISORS (DETERMINATION OF LAKE'S NATURAL WATER LEVEL BY A COURT).

276 Mich 591, 268 NW 750-752 (1936).

Descriptors: *Michigan, *Lakes, *Water levels, *Jurisdiction, Water measurement, Height, Flumes, Fluctuation, Variability, Water loss, Evaporation, Seepage, Inland waterways, Lake shores, Sea level, Elevation, Adjudication procedure, Judicial decisions, Legal aspects.

Appellee board of supervisors petitioned the circuit court for a determination of the natural height and level of the water of two inland lakes. The petition was based upon a state statute conferring jurisdiction in such matters on state circuit courts. Appellant village contested the petition. After hearing expert testimony, the circuit court entered its order fixing the level of the lakes. Appellant contended that the statute did not and could not confer the right to fix the water level of the lakes upon the circuit court. The Supreme Court of Michigan affirmed the circuit court's order, holding that the statute conferred jurisdiction upon the circuit court to determine the natural water level of the lakes. (Quesada-Florida)
W70-10480

2I. Water in Plants

INVASION OF THE AQUATIC HABITAT BY AMPHIBIOUS SPECIES OF POLYGONUM,
Virginia Polytechnic Inst., Blacksburg. Dept. of Botany.
Richard S. Mitchell.
Available from NTIS as PB-194 454, $3.00 in paper copy, $0.65 in microfiche. Project Completion Report, August 1970. 24 p, 3 fig, 4 ref. OWRR Project A-028-VA (1).

Descriptors: *Aquatic plants, *Amphibious plants, *Plant tissues, *Plant morphology, Aquatic weeds, Rooted aquatic plants, Vegetation regrowth, Tropisms, Epidermis, Foliar, Moisture stress, Growth chambers, Plant ecology, Smartweeds, Polygonum.

This report covers a two year study of the aquatic capabilities of members of the plant genus Polygonum (section Persicaria). Amphibious water-weeds of this group are capable of covering the entire surface of a reservoir within two years. Included in the study is discussion of the rediscovery of P. meisnerianum, a little known invader of lakes. A leaf anatomy study is discussed, but the major body of data is reserved for later publication. A series of experiments on tropisms is discussed in full. These indicate that prostrateness is partially genetically controlled and partially an inhibition o negative geotropism by light. Plagiotropy was most pronounced in amphibious plants. A series of inundation experiments was carried out in environmental chambers. After cloning the plants they were separated into two groups, one of which was submerged in an aquarium and the other grown aerially as a control. Vegetative and anatomical comparisons were made after 30 days, and 23 populations were ranked on their amphibious responses to submergence. Amphibious varieties of P. amphibium scored highest, as expected, but P. amphibium var. emersum scored below some less closely related taxa. The work strengthened suspicions that P. amphibium is of Eurasian origin with no close relatives here; however, P. densiflorum which is distantly related, appears on the verge of becoming a true aquatic.
W70-10113

FACTORS AFFECTING DETERMINATION OF IRRIGATION WATER REQUIREMENTS,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 03F.
W70-10134

GROWTH OF PHYTOPLANKTON AND VASCULAR AQUATIC PLANTS AT DIFFERENT NUTRIENT LEVELS,
Cornell Univ., Ithaca. Dept. of Botany.
For primary bibliographic entry see Field 02H.
W70-10160

MANAGEMENT OF AQUATIC VASCULAR PLANTS AND ALGAE,
Cornell Univ., Ithaca, N.Y. Dept. of Botany.
Hugh F. Mulligan.
Eutrophication: Causes, consequences, correctives, p 464-482. Printing and Publishing Office, National Academy of Sciences, Washington, D.C., 1969. 2 tab, 110 ref.

Descriptors: *Aquatic weed control, *Aquatic plants, *Herbicides, *Vascular tissues, *Algae, Ecosystems, Chara, Benthic flora, Floating plants, Phytoplankton, Aquatic insects, Fish, Game birds, Animals, Food chains, Oxygen, Rotifers, Weeds, Water hyacinth, Alligatorweed, Chemcontrol, Mechanical control, Biocontrol, Copper sulfate, Sodium arsenite, Diquat, Toxicity, Snails, Mammals, Tilapia, Carp, Fertilization, Northeast US, New York, Tennessee Valley, 2-4-D.
Identifiers: Ceratophyllum, Myriophyllum, Eichhornia, Potamogeton, Trapa, Pistia, Alternanthera, Heteranthera, Najas, Silvex, Endothal, Potassium permanganate, Fenac, Silver nitrate, Simazin, Nuphar, Agasicles, Manatee, Marisa.

Chemical treatments offer, at best, temporary relief from overabundance of aquatic vegetation. Even when excellent results are obtained, treatments must be repeated annually. Presently, aquatic herbicides are nonselective, usually killing all plants by contact. It would be more efficacious to use aquatic herbicides possessing selective toxicity against specific aquatic weeds, thus permitting the reestablishment of desirable plants. The cost of developing aquatic herbicides would be greater as apposed to agricultural herbicides because of the specialized testing requirements, and generally, the potential market would not be as great. Mechanical control is very promising: it involves hand-pulling or cutting and harvesting plants from restricted areas. Biological control has met with only limited success, but is an avenue of promising potential. This approach would include introducing organisms that are inimical to the target organisms and manipulating the existing aquatic environment. In a concept, this type of control uses biology against biology. Among the organisms utilized in control of aquatic plants are fish, snails, mammals, and beetles. Biological control is the only method that could provide a permanent solution to the problem of excessive aquatic vegetation. (See also W70-03975) (Jones-Wisconsin)
W70-10175

IMPROVING TREE TRANSPIRATION ESTIMATES BASED ON HEAT PULSE VELOCITY MEASUREMENTS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02D.
W70-10286

WATER RELATIONS OF MAIZE: PART 1. - EFFECTS OF SEVERE SOIL MOISTURE STRESS IMPOSED AT DIFFERENT STAGES OF GROWTH ON GRAIN YIELDS OF MAIZE,
Rhodesia Dept. of Research and Specialist Services, Salisbury.
For primary bibliographic entry see Field 03F.
W70-10289

WATER RELATIONS OF MAIZE: PART 2. - THE EFFECTS OF NINE IRRIGATION REGIMES ON MAIZE,
Rhodesia Dept. of Research and Specialist Services, Salisbury.
For primary bibliographic entry see Field 03F.
W70-10290

EFFECTS OF SIMULATED GRAZING ON SOI MOISTURE CONTENT IN MID-ELEVATIO RESEEDED RANGELAND,
Utah State Univ., Logan.
For primary bibliographic entry see Field 03F.
W70-10291

CRITICAL FACTORS DURING THE FIRS YEARS OF LIFE OF THE SAGUARO (CEREU GIGANTEUS) AT SAGUARO NATIONA MONUMENT, ARIZONA,
Saguaro National Monument, Tucson, Ariz.; a
Arizona Univ., Tucson.
Warren F. Steenbergh, and Charles H. Lowe.
Ecology, Vol 50, No 5, p 825-834, Late Summ 1969. 8 fig, 2 tab, 15 ref.

Descriptors: *Cacti, *Arizona, *Environmental e fects, *Germination, *Vegetation establishmer Desert plants, Arid lands, Drought, Rainfall, Lim ing factors, Plant growth, Plant populatio Growth rates, Growth stages, Plant physiolog Age, Seeds, Population, Habitat, Microenviro ment, Viability, Mortality, Rodents, Insects.
Identifiers: *Saguaro cactus, *Sonoran Dese *Seedlings.

During 1965-1966 the germination and establis ment of giant saguaro (Cereus giganteus Engelm were investigated in field studies at Saguaro N tional Monument, Arizona. Field germination e periments were conducted and natural seedli populations were periodically observed in fl rolling hill, and rocky terrain habitats. The reaso that such a small number of saguaro germinatio occur are bird, mammal, and insect predation the seeds and also insufficient moisture for ge mination. Germination begins in July after the st of the summer rains and continues into Septembe These rains are important because they dislod seeds from fruits, transport the seeds to protect sites and provide moisture for germination. To precipitation is greater on the flats and rolling hi than in the rocky habitat, which may partially e plain the lower germination rates in the latter are Seedling mortality, however, is lowest in rocky te rain. Seedling establishment is limited by roden insects, frost, and drought, with size and extent seedling growth appearing to depend primarily soil moisture availability immediately below t soil surface. Principal apical stem growth occu during the summer rains. New growth also tak place during the winter rains of February a March. (Carr-Arizona)
W70-10292

THE EXPECTED EFFICIENCY OF WATE UTILIZATION IN PLANTS UNDER DIFFEREN COMPETITION AND SELECTION REGIMES,
Hebrew Univ., Jerusalem (Israel). Dept. of Botan
For primary bibliographic entry see Field 02D.
W70-10294

WHY CONSERVE NATURAL VEGETATION,
B. Verdcourt.
In: Conservation of Vegetation in Africa South the Sahara, p 1-9, Acta Phytogeographica Sueci 54, Uppsala, 1968. 14 refs.

Descriptors: *Forests, *Watersheds (Divide *Ecology, *Ecosystems, *Vegetation effec Evapotranspiration, Runoff, Water conservatio Social impact, Conservation, Erosion, Fertility, S conservation, Soil moisture, Soil stabilization, So water-plant relationships, Infiltration.
Identifiers: *Disturbed areas.

The author argues for widespread conservation natural vegetation from both philosophical a practical considerations. Practical values discuss include direct uses such as drug and new fo sources, scenic values, climatic effects and ener conservation, but particularly stressed are wat supply maintenance, prevention of soil erosion a conservation of soil fertility. East Afric catchment area studies have shown that natural well managed forests are unsurpassed for maximu

infiltration and natural control of stormflow or surface rungoff. This is primarily due to the combination of very porous soils, surface litter and the protective canopy which prevents erosion during intense tropical rains. When disturbances occur, such as the introduction of grazing animals during lowland dry seasons, water and nutrient retention capacity is severely damaged. A draw back with forests, however, is the tremendous water loss due to evapotranspiration, and in areas of less than 40-50 inches yearly rainfall, cultivation of arable land may actually increase ground water supplies. Similar examples may be drawn from other areas of natural vegetation. The goals of the ecologist and the agronomist are often counter to each other. (Casey-Arizona)
W70-10300

SODIUM-22 RETENTION AS A FUNCTION OF WATER INTAKE BY CITELLUS LATERALIS,
New Mexico Univ., Albuquerque. Dept. of Biology.
Gary L. Bintz.
In: Physiological Systems in Semiarid Environments, University of New Mexico Press, p 45-52, 1969. 2 fig, 1 tab, 6 ref. Contract AT (29-2)-1629 USAEC.

Descriptors: *Xerophilic animals, *Moisture deficit, *Water balance, *Rodents, *Radioactivity techniques, Metabolism, Physiological ecology, Moisture stress, Animal physiology, Sodium, Laboratory tests, Semiarid climates.
Identifiers: *Ground squirrels, *Hibernation, *Biological half-life, Field-adapted animals, Laboratory-acclimated animals, Water excretion.

Hibernating animals are apparently able to tolerate water stress for at least 3 weeks. Some evidence indicates the ability to carry this tolerance over into non-hibernating periods. Additionally there are indications that laboratory-acclimated animals do not retain the ability. Recently captured and laboratory-acclimated ground squirrels were subjected to differing water intakes for 1 week and then injected with Na-22. Their radioactivity retention was then measured over a period time. Lab animals excreted 22% of the isotope in the first 24 hours following injection, while field animals excreted only 7 percent. Retention in lab animals indicated approximate water requirements of 10 milliliters per 100 grams body weight per day while those of field animals were 5 milliliters per 100 grams body weight per day. Above a minimal water-intake level Na excretion appeared independent of water excretion. Either field animals posses a water stress tolerance mechanism subsequently lost by lab animals or lab animals are overhydrated and able to lose more water before water conservation becomes critical. (Casey-Arizona)
W70-10304

CHALLENGES AND OPPORTUNITIES FOR DESERT PLANT PHYSIOLOGISTS,
Nevada Univ., Reno. Desert Research Inst.
F. W. Went.
In: Physiological Systems in Semiarid Environments, p 219-230, University of New Mexico Press, Albuquerque, 1969.

Descriptors: *Xerophytes, *Competition, *Inhibitors, *Plant growth, *Distribution patterns, Ecology, Shrubs, Physiological ecology, Seeds, Arid lands, Osmotic pressure, Precipitation (Atmospheric), Temperature, Root systems, Tropical regions, Desert plants, Rainfall disposition, Germination, Soil-water-plant relationships.
Identifiers: *Autoinhibitors, *Climatic factors, *Annuals (Plants), Mojave Desert, Mycorrhizas, Seed production.

The problems involving water balance in desert plants are: (1) The mechanisms by which transpiration levels are reduced far below those achievable merely by stomatal closure; (2) The reasons why annuals do not extend their root systems beyond a very shallow soil layer in order to extract more water from a larger soil volume, and whether or not upper soil layer dew formation is a factor. Competition, contrary to general views, is felt to be at most a minor factor in plant distribution. Seed populations are controlled by animals and germination is selected for by precise germination control mechanisms. A number of examples are given in which the other plants in the neighborhood of a given plant do not exert limiting factors on its growth. Additionally, what were formerly considered intraspecific growth inhibitors produced by roots of desert shrubs such as Larrea are now considered autoinhibitors. All growth regulation seems to be independent of neighboring plants and it is suggested that this theory may also be extended to plant growth and distribution in non-desert areas. (Casey-Arizona)
W70-10305

PHYSIOLOGICAL RESPONSES OF PLANTS TO SALINITY: PLANT-WATER RELATIONS,
Arizona Univ., Tucson. Environmental Research Lab.
James J. Riley.
In: Physiological Systems in Semiarid Environments, p 249-254, University of New Mexico Press, Albuquerque, 1969. 3 tab, 2 fig, 9 ref.

Descriptors: *Osmotic pressure, *Salt tolerance, *Soil-water-plant relationships, *Transpiration, Sodium Chloride, Sulphates, Chlorides, Calcium, Stomata, Diffusion, Leaves, Physiological ecology, Plant physiology, Saline water, Root systems.
Identifiers: *Plant water potential, *Plant pressure potential, *Root water resistance, *Sap contents, Ethylene glycol, Physiological drought.

Although saline water reduces plant growth, the exact physiological systems are not understood. Red kidney bean (Phaseolus vulgaris) seedlings grown hydroponically were gradually brought to 2 and 4 atmospheres above medium level with single salt solutions of NaCl, calcium chloride, sodium sulfate or carbowax 1540 (ethylene glycol). Except with NaCl solutions, the osmotic gradient between solution and leaves decreased with increasing concentration. In all cases, water potential gradients between leaves and solution decreased with increasing concentration. Both root resistance to water movement and leaf diffusion resistance were higher in treated plants than controls. In plants treated with carbowax and sodium sulfate a water potential adjustment occurred and transpiration levels were higher. It was concluded that: (1)Sap osmotic adjustment does not indicate a water potential adjustment (2) Resistance to water movement, especially in roots may be an important consideration. (Casey-Arizona)
W70-10306

THE EFFECT OF SALT CONCENTRATION ON THE GROWTH AND METABOLISM OF A SUCCULENT HALOPHYTE,
Utah Univ., Salt Lake City. Dept. of Botany.
Irving McNulty.
In: Physiological Systems In Semiarid Environments, p 255-262, University of New Mexico Press, Albuquerque, 1969. 6 fig. NSF Grant GB-3485.

Descriptors: *Xerophytes, *Halophytes, *Soil-water-plant relationships, *Salt tolerance, *Chlorides, Plant physiology, Physiological ecology, Metabolism, Plant growth, Respiration, Photosynthesis, Arid lands, Osmotic pressure, Sulphates, Sodium, Potassium, Laboratory tests, Leaves, Light, Carbon dioxide, Stomata, Salts.
Identifiers: *Succulents, *Greasewood, *Physiological drouth, Environmental chambers, Succulence, Photosynthesis-respiration ratios, Water potential, Seedlings.

Seedlings of a woody, succulent-leafed halophyte, greasewood (Sarcobatus vermiculatus Hook), were grown in nutrient media and 50- or 100-millimolar increments of NaCl, KCl or sodium sulfate were added at 3- or 10-day intervals until a final concentration of 1 millimolar was achieved. Lear osmotic adjustments occurred rapidly in all treatments maintaining a favorable water gradient of 2-3 times greater osmotic pressure than the root medium. Small amounts of salt stimulated growth while larger amounts were inhibitory. Maximal growth concentrations were 2 atmospheres for chloride solutions and 5 for sulfate solutions, indicating that chloride ion rather than osmotic pressure was the inhibitory factor in the growth medium. Respiratory rates in salt-treated plants were below control levels. Inhibition of photosynthesis with NaCl increased with concentration. The photosynthesis-respiration ratio was also inversely proportional to salt concentration and indicated a greater reduction in photosynthesis than respiration. Leaf succulence as measured by length-thickness ratios increased with chloride concentration. The more succulent form may not be as efficient in carbon dioxide uptake. (Casey-Arizona)
W70-10307

GRADIENTS IN SPECIES COMPOSITION OF DESERT VEGETATION NEAR EL PASO, TEXAS,
Texas Univ., Arlington. Dept. of Biology.
John S. Williams.
In: Physiological Systems in Semiarid Environments, p 273-283, University of New Mexico Press, Albuquerque, 1969. 3 fig, 2 tab, 13 ref.

Descriptors: *New Mexico, *Xerophytes, *Arroyos, *Arid lands, *Soil-water-plant relationships, Ecology, Geology, Geomorphology, Alluvial channels, Soils, Vegetation establishment, Vegetation regrowth, Climates, On-site investigations, Plant populations.
Identifiers: *Rio Grande Valley, *Plant communities, *Species composition, *Importance values, Disturbing factors.

Gradients in species composition in plant communities are effected by a variety of interacting environmental factors that are often difficult to isolate and measure. In this paper vegetation, soils, climate geology and geomorphology of the Rio Grande Valley are described and historical records are reviewed. This area is an arid region with great phytographic diversity resulting mainly from various disturbing factors. It is subject to the formation of many new arroyos and deepening of older ones. Plant communities in the arroyos were surveyed; importance values of species determined; and species compositions correlated with arroyo structure. Two important plants were Fouquieria splendens, whose presence delineated arroyo importance, and Larrea divericata, which disappeared as arroyo deepening increased. Other importance species were tabulated and their significance described. In terms of plant communities, 4 overlapping zones were observed as arroyo development progressed. (Casey-Arizona)
W70-10308

THE ECOLOGICAL BACKGROUND TO LAND-USE STUDIES IN TROPICAL AFRICA, WITH SPECIAL REFERENCE TO THE WEST,
Birmingham Univ. (England). Dept. of Geography.
R. P. Moss.
In: Environment and Land Use in Africa, Chapter 8, p 193-238, Methuen, London, 1969. 10 fig, 6 tab, 129 ref.

Descriptors: *Soil-water-plant relationships, *Soil properties, *Ecology, *Agriculture, *Land use, Evapotranspiration, Precipitation (Atmospheric), Tropical regions, Arid lands, Semiarid climates, Animal populations, Plant populations, Planning, Rain forests, Nutrients, Fire, Grazing, Water distribution (Applied), Habitats, Biomass, Ecosystems, Grasslands.
Identifiers: *West Africa, *Ecological-agricultural interrelationships, *Nutrient cycling, *Game ranching.

Studies of land use patterns must be in terms of the ecological and agricultural factors that produced them and therefore involve insight into the strong interdependence between vegetation and soils.

Various ecosystems in West Africa--humid rain forests, savannahs, arid areas and montane regions--are therefore evaluated in this light. Tropical rain forests are characterized by high precipitation, high evapotranspiration, low percolation and low runoff. Organic and mineral nutrient recycling systems are virtually closed and constant. Savannahs are more widespread than forest areas and are characterized by: (1) much less vegetational biomass; (2) seasonal rather than continual water and nutrient cycling; (3) fire as an important ecological factor; and (4) horizontal zonation due to climatic, edaphic and anthropogenic factors. The present fauna and flora of forest and savannah are described, as well as their agricultural potentialities and limitations. Montane regions are complex and hold great agricultural potential but are also important watersheds. The implications of land use go beyond plants and soils and also include pest and disease patterns involving plants, animals and humans--all of which need to be rationally assessed. (Casey-Arizona)
W70-10309

THE DORMANCY AND SURVIVAL OF PLANTS IN THE HUMID TROPICS,
Ghana Univ., Legon. Dept. of Botany.
K. A. Longman.
Symposium of the Society of Experimental Biology, Vol 23, p 471-488, Cambridge University Press, 1969. 6 fig, 3 tab, 32 ref.

Descriptors: *Germination, *Photoactivation, *Temperature control, *Moisture availability, *Tropical regions, Humid climates, Humidity, Physiological ecology, Ecology, Plant physiology, Growth stages, Laboratory tests.
Identifiers: *Dormancy, *Pre-dormancy, *Budbreak, Bud dormancy, Seed dormancy.

Contrary to widespread belief, tropical climates may be highly variable. Consequently, plant growth is highly variable and dormancy is common. Two kinds of dormancy are considered: (1) bud dormancy in forest trees (2) seed dormancy in weeds colonizing open, disturbed ground. Short day-length lab experiments on several tropical tree species showed pre-dormancy mechanisms characterized by reduction or absence of both shoot growth and leaf production. After some time, with unchanged photoperiod, bud-break and renewed leaf expansion occurred. Temperature and photoperiod seem to be the initiating factors, although extrapolation of lab results to field conditions must be done cautiously. Mature plants and seedling differ distinctly in photoperiod responses and growth habits, the dormant period increasing with seedling age. In many tree species the short yearly growth period is precisely timed and occurs during the dryer season, probably because solar radiation and temperature are more crucial limiting factors than moisture. Unlike bud dormancy, tropical seed dormancy is more closely related to survival during dry periods and germination therefore occurs during rainy seasons. Since temperature, rain and photoperiod are all functionally related, different combinations of these depending on the species, may, as in the desert, trigger germination. (Casey-Arizona)
W70-10313

WATER REGULATION ON FOREST LAND.
Forest Service (USDA), Charleston. Southeastern Forest Experiment Station.
Ralph A. Klawitter.
Journal of Forestry, 68 (6):338-342, June 1970.

Descriptors: *Wetlands, *Coniferous forests, *Design criteria.
Identifiers: *Water regulation, *Timber production, *Bays, *Bottomlands, *Wet flats.

One key objective of water regulation on wet forest land is to increase timber production. Other objectives are to improve wildlife habitat, range land, and flood control. Wetland forests vary widely in site conditions and in their responses to water and soil management. Each kind--swamps, bottomlands, bays, and wet flats--must receive a prescription suited to local peculiarities, because water regulation works best when properly applied to the task for which it is designed. Measures applied, however, must be well enough understood and sufficiently controlled to enable changes in design and shifts in productivity from one resource use to another as the future demands.
W70-10408

DOES BEDDING PROMOTE PINE SURVIVAL AND GROWTH ON DITCHED WET SANDS.
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
Ralph A. Klawitter.
Northeastern Forest Experiment Station, USDA, Forest Service Research Note NE-109, 1970. 4 p.

Descriptors: *Drainage, *Plant growth, *Pine trees, *Wetlands, *Sands, Florida.
Identifiers: *Bedding, *Survival.

Results from a study of prepared beds for planting slash pine on a wet sandy flat in Florida were inconclusive. Early growth was improved, but survival was not; and differences between a bedded site and an unbedded site were slight.
W70-10409

2J. Erosion and Sedimentation

PROBING THE MEDITERRANEAN'S HIDDEN GEOLOGICAL PAST.

Science News, Vol. 98, No. 1, p. 20-21, July 4, 1970. 2 fig.

Descriptors: *Sedimentology, Structural geology, *Drilling, *Geologic time.
Identifiers: *Deep Sea Drilling Project, Glomar Challenger, *Mediterranean Ridge, Tethys, Nile Cone.

The thirteenth voyage of the deep sea drilling ship Glomar Challenger will be an expedition to the Mediterranean Sea. Drillings will be made in over ten sites at a depth of approximately 1000 meters below the sea bottom. The expedition will attempt to unravel the geological history of the Mediterranean sea and its adjacent land masses as well as the chronology of faunal changes and organic deposits. Such puzzles as the formation of the Mediterranean Ridge and of the three basins in the western Mediterranean, and the disappearance of the Tethys waterway will be investigated. (Holmes-Rutgers)
W70-10184

FOSSIL WATER,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 02K.
W70-10234

FLUME WIDTH AND WATER DEPTH EFFECTS IN SEDIMENT-TRANSPORT EXPERIMENTS,
Geological Survey, Washington, D.C.
Garnett P. Williams.
For sale by the Superintendent of Documents, US Government Printing Office, Washington, DC , 20402 - Price 55 cents. US Geological Survey Professional Paper 562-H, 1970. 37 p, 17 fig, 2 tab, 26 ref.

Descriptors: *Sediment transport, *Flumes, *Width, *Hydraulic similitude, *Hydraulic models, Laboratory tests, Alluvial channels, Bed load, Channel morphology, Hydraulics.
Identifiers: Sediment transport flumes, Width effects.

This paper reports 177 flume experiments made in channels of different widths and water depths, to find how the flume dimensions influence expe mental results. Sediment transport rates, grain siz water depth, and channel width were controlle the dependent variables were water dischar mean velocity, slope, and bed-form. The flu widths were 0.25, 0.5, 1.0, and 2.0 ft. In a channe ft wide flume sidewall effects very nearly completely disappeared. Narrower channels, whe wall effects were pronounced, could therefore compared to wide channels in which wall effe were absent. The slope decreased as the chan became wider, for a given unit transport rate a water depth. Multiplying the laboratory value slope, unit stream power, or shear stress by the a justment factor gives the slope power, or shear fo wide channel for the same water depth and u sediment-transport rate. Adjustment factors a are given for correcting the unit sediment-transp rate for sidewall effects, taking transport rate a dependent variable and stream power as the fl quantity which governs transport rate. Tests of t validity of the Johnson-Brooks sidewall correcti procedure showed that for the present movab bed data the degree of agreement between p dicted and measured flow depths varied with t hydraulic or transport conditions. Best agreeme usually occurred with channels 1 ft or more wi and for runs which did not have extremely rou beds. A review of the literature suggests that many rigid-boundary flows this sidewall correcti procedure is reasonably reliable. (Knapp-USGS)
W70-10244

EFFECT OF A POROUS SAND BED ON I CIPIENT SEDIMENT MOTION,
Georgia Inst. of Tech., Atlanta.
C. S. Martin.
Water Resources Research, Vol 6, No 4, p 116 1174, August 1970. 13 p, 9 fig, 25 ref. OWRR P jects B-004-GA and B-019-GA.

Descriptors: *Sediment transport, *Scour, Strea erosion, *Sands, *Permeability, Porous media, luvial channels, Seepage, Groundwater moveme Deposition (Sediments), Waves (Water), She Shear drag, Shear stress, Model studies, Hydrau models.
Identifiers: Sediment movement.

Incipient motion tests were conducted for flow in and out of a porous bed. Seepage out of a bed do not affect incipient motion measurably because t seepage force is lost once a sediment particle roc Seepage into a bed may either enhance or hind incipient motion, depending upon the relative fect of the boundary shear stress and the seepa force, both of which depend on the seepage flo For a given hydraulic gradient the size of the sa grains is critical regarding incipient motion. Fo turbid water flow over a bed, fine particles of t mixture may become deposited in the bed, resu ing in a more resistant bed. Typical values of t hydraulic gradient are given for flow out of a ca and in an ocean bed under oscillatory waves. napp-USGS)
W70-10251

SEDIMENT SAMPLING IN AUSTRALIA.
Australian Water Resources Council, Canberra.

Australian Water Resources Council Hydrologi Series No 3, 1969. 47 p, 2 fig, 214 ref, 6 append.

Descriptors: *Sedimentation, *Sampling, *M surement, *Sediments, Sediment transpo Foreign research, Sediment load, Sedimentati rates, Sediment yield, Bed load, Suspended lo Data collections.
Identifiers: *Australia.

Recommendations are given for methods of c lecting data on sediments in streams and reservo in Australia. There are areas where rates of erosi are serious, and sediment problems are widespre throughout the country even in areas which are garded as relatively stable. The methods of d collection and techniques of analysis now used

water resources organizations in Australia in the fields of suspended sediment transport, bed load transport, and reservoir sedimentation are reviewed. Very little data is being collected in Australia, and the amount and quality varies considerably throughout the country. Nuclear density probes have been used widely for the measurements of in-situ sediment density and there is scope for their use in Australia. Information collected from representative basins should be supplemented by sampling from a number of larger catchments. The total network of sediment measuring stations should be at least 200, and should be established by taking sediment records at approximately 1 in every 15 stream gaging stations. Systematic measurement should be made of reservoir sedimentation. There is a need for the continuous automatic measurement and recording of the sediment concentration in rivers. The data available should be published every five years on a national basis. (Knapp-USGS)
W70-10255

COASTAL EROSION IN NORTH CAROLINA,
North Carolina State Univ., Raleigh. Dept. of Civil Engineering; and Clemson Univ., S. C. Dept. of Civil Engineering.
Leonard J. Langfelder, Donald B. Stafford, and Michael Amein.
ASCE Proceedings, Journal of the Waterways and Harbors Division, Vol 96, No WW 2, Paper 7306, p 531-545, May 1970. 15 p, 4 fig, 2 tab, 14 ref.

Descriptors: *Beach erosion, *Coasts, *North Carolina, Beaches, Erosion, Waves (Water), Ocean waves, Computer programs, Littoral drift, Mathematical models, Aerial photography, Refraction (Water waves).
Identifiers: Cape Hatteras (N C).

Aerial photography and wave refraction procedures were used to study coastal erosion along the entire 330 miles of the North Carolina coast. The aerial photography method made use of measurements made at 1,400 selected stable measuring points on photographs that were taken as early as 1938. The wave refraction method made use of a computer program to obtain the refracted directions of selected incoming waves. The longshore wave energy was then converted to littoral drift through the use of an empirical equation. The results of both methods indicate the general trend in erosion. Erosion caused by major storms is a significant portion of the total erosion. This storm-induced erosion is included in the results of the aerial photography method but has only a small influence on the results of the wave refraction method. (Knapp-USGS)
W70-10265

STRATIGRAPHY OF UNCONSOLIDATED SEDIMENTS IN THE SOUTHERN PART OF LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
J. A. Lineback, N. J. Ayer, and D. L. Gross.
Illinois Geological Survey Environmental Geology Notes, Note No 35, August 1970. 35 p, 6 fig, 15 ref, append.

Descriptors: *Bottom sediments, *Lake Michigan, *Illinois, Stratigraphy, Glacial drift, Lakes, Sands, Silts, Clays, Mud, Bottom sediments.
Identifiers: Lake Michigan sediments.

Unconsolidated sediments of late Pleistocene age in southern Lake Michigan can be divided into two major lithologic units. The upper unit is dominantly lacustrine clay of high water content that is soft and variably fossiliferous. The lower unit consists of compact sandy sediments of glacial origin. The upper unit was deposited after the direct influence of the last glacier was felt in southern Lake Michigan. Underlying is a series of glacial-lacustrine deposits, including sand, sandy pebbly clay, silt, and clay-pebble conglomerate. They show the direct effect of nearby glaciers. (Knapp-USGS)
W70-10274

EROSION, RUNOFF, AND REVEGETATION OF DENUDED CONSTRUCTION SITES,
Agricultural Research Service, Lafayette, Ind. Soil and Water Conservation Research Div.; and Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 04D.
W70-10280

SEDIMENTATION IN THE FOREDELTA OF THE VOLGA RIVER,
Astrakhan State Reservation (USSR).
Ye. F. Belevich.
Translated from Okeanologiya, Vol 9, No 6, 1969. Oceanology, Vol 9, No 6, p 808-816, 1969. 2 fig, 1 tab, 15 ref.

Descriptors: *Sedimentation, *Deltas, *Water level fluctuations, Deposition (Sediments), Sedimentary structures, Sediments, Sediment transport, Streamflow.
Identifiers: Volga River.

The foredelta of the Volga River has a smooth, but fairly complex bottom relief and represents the transition zone (35-60 km x 200 km) from the above-water delta to the deeper part of the Volga mouth area. Sedimentation in the foredelta occurs under the influence of drift and discharge currents, waves, the inflow of sediments, water level oscillations, and the development of vegetation. Three major types of deposits form: alluvial, made up of slightly modified alluvial sediments; marine, consisting of silt and shells, worked over many times by currents or swash; and residual deposits, formed as a result of the erosion of bottom deposits. Residual deposits are specific features of modern foredeltas. (Knapp-USGS)
W70-10281

QUANTITATIVE DISTRIBUTION OF SUSPENDED MATTER IN THE CENTRAL AND SOUTHEASTERN PARTS OF THE BALTIC SEA,
Akademiya Nauk SSSR. Institut Okeanologii.
O. S. Pustel'nikov.
Translated from Okeanologiya, Vol 9, No 6, 1969. Oceanology, Vol 9, No 6, p 816-827, 1969. 4 fig, 4 tab, 24 ref.

Descriptors: *Suspended load, *Oceans, *Sediments, *Sampling, Geology, Provenance, Nutrients, Silts, Particle size, Surveys, Data collections, Mapping.
Identifiers: Baltic Sea, USSR.

The distribution of suspended matter in the Baltic Sea water was examined. From a study of 317 samples (from 149 stations), collected on a filter with 0.5 micron pores, it was found that the maximum concentrations of suspended matter (1.1-12.4 mg/liter) are confined to regions near abrasion coasts and the mouths of straits. Increased concentrations of suspended matter in the open sea are produced by organisms. The minimum content of suspended matter was found in the layer from 30 to 120 m. Concentration increased markedly again at the bottom. (Knapp-USGS)
W70-10282

ORGANIC MATTER OF RECENT SEDIMENTS OF THE CASPIAN SEA,
Institute of Geology and Fuel Mineral Processing, Moscow (USSR).
O. K. Bordovskiy.
Translated from Okeanologiya, Vol 9, No 6, 1969. Oceanology, Vol 9, No 6, p 799-807, 1969. 6 fig, 3 tab, 11 ref.

Descriptors: *Bottom sediments, *Organic matter, Asphalt, Bituminous materials, Humus, Humic acids, Silts, Clays, Sampling.
Identifiers: Caspian Sea.

The distribution and composition of the organic matter of recent Caspian sediments are discussed. The carbon concentration increases with the degree of dispersion of the sediments and reaches a maximum in clayey silts of the deep water basins of the middle and southern Caspian. The degree of bituminization of organic matter is inversely proportional to the concentration of organic carbon. In the group composition of bitumens, asphaltenes (average 47.2%) and tars (37.4%) predominate. The content of oils averages 14%. Methane-naphthene hydrocarbons predominate in the composition of the oil fraction (60-70%). The amount of aromatic hydrocarbons is 3-10%. A nearly linear relationship is observed between bitumens and humic acids. (Knapp-USGS)
W70-10283

ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION 1966-1968, UNITED STATES AND CANADA.
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 02E.
W70-10318

SOME PRINCIPLES OF FOREST HYDROLOGY PERTINENT TO EVEN-AGED MANAGEMENT OF EASTERN HARDWOODS,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04C.
W70-10421

LAMPREY V AMERICAN HOIST AND DERRICK CO (TITLE TO ACCRETION).

266 NW 434-441 (Minn 1936).

Descriptors: *Minnesota, *Land forming, *Accretion (Legal aspects), *Land tenure, Permits, Leases, Reliction, Landfills, Shores, Boundary disputes, Mississippi River, Riparian rights, Riparian land, Public rights, Easements, Navigable rivers, Navigable waters, Judicial decisions, Legal aspects, Access routes.

Predecessors of plaintiffs owned land bounded on the north by the Mississippi River. Between the river and the lots in contest was a dedicated street. The lots, platted with the river as their northerly boundary, were conveyed by plaintiffs' predecessor to defendant. Since that time, land had been created north of the old river line by accretion. Plaintiffs contended that their predecessors retained a fee in the northern half of the dedicated street, any land then existing north of the street and any land added thereto by accretion or reliction. The court, in affirming a judgment for defendant, ruled that the lots conveyed were in fact bounded by the river. Defendant, after purchasing the lots, could well assume that there was nothing between such lots and the river to interfere with or prevent his free access from his lots to the river. Plaintiffs' predecessors conveyed all their interest in the street and the land and the riparian rights attached thereto when they sold their lots, and defendants took such rights subject only to the public easement in the street. (Price-Florida)
W70-10482

2K. Chemical Processes

MEASUREMENT OF THE MOLECULAR SIZE OF A SODIUM HUMATE FRACTION,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 02G.
W70-10074

AUTOMATION OF ATOMIC ABSORPTION ANALYSES,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07B.
W70-10089

DROPLET FREEZING BY SURFACE NUCLEATION,
State Univ. of New York, Albany.

For primary bibliographic entry see Field 02C.
W70-10091

OXYGEN-18 AND TRITIUM IN THE EVIAN BASIN (FRENCH),
Geodynamics Investigation Center, Paris (France).
J. C. Fontes, and R. Letolle, Ph. Olive, and B. Blavoux.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/28, p 401-415, 1967. 15 p, 6 fig, 4 tab, 10 ref.

Descriptors: *Stable isotopes, *Tritium, *Water chemistry, *Groundwater movements, *Groundwater basins, Tracers, Radioactive dating, Tracking techniques, Radioactivity techniques, Water analysis, Water levels, Hydrogeology.
Identifiers: France, Evian Basin.

Isotopic surveys of the Evian basin (precipitation, surface system, test wells and springs) have been going on since 1962. Measurement of oxygen-18 and tritium content have made it possible to determine the mean height of the drainage area and to consider various hypotheses in connection with the hydrodynamics of the water table. It has also been possible to determine the behavior of recent meteoric water and its possible contribution to the water-table supply. The data derived from hydrological studies are in good agreement with the set of isotopic results. The isotopic measurements have also been used to plan the catchment area equipment and to fix the test-well sites. In view of the theoretical and even economic importance of such coordinated isotopic studies, it is proposed that systematic sampling be organized on an international scale on the site on the main catchment areas presenting serious hydrogeological problems. (Knapp-USGS)
W70-10095

SOIL-WATER MOVEMENT AND EVAPOTRANSPIRATION: CHANGES IN THE ISOTOPIC COMPOSITION OF THE WATER,
Heidelberg Univ. (West Germany). Physikalisches Institut (II).
U. Zimmermann, D. Ehhalt, and K. O. Munnich.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/38, p 567-585, 1967. 19 p, 17 fig, 1 tab, 17 ref.

Descriptors: *Soil water movement, *Evapotranspiration, *Tracers, *Deuterium, *Tritium, Evaporation, Transpiration, Tracking techniques, Groundwater movement, Stable isotopes, Radioisotopes, Water chemistry.
Identifiers: Isotopic concentration.

An artificial rainfall spiked with tritium may be used to estimate the amount of rain fallen after the date of tracer input. Dispersion is usually combined with a scatter in the position of the tracer maximum in parallel cores. Among recent improvements in sample processing is newly developed equipment to distill six samples simultaneously. The change in stable isotope composition of the soil water during downward movement has also been studied in detail. Experiments show that plant transpiration results in practically no isotopic enrichment of soil water. The considerable average velocity with which the water moves upward from the root to the leaves makes this possible despite heavy enrichment of the water in the leaves. Under central European conditions a bare soil may, however, show a deuterium enrichment up to about 20% in the top layers. It is obvious that evaporation from the soil, and therefore enrichment, is strongly suppressed by plant cover, espically during summer. A bare soil under the same conditions as a planted one showed, in a number of measurements, deuterium enrichment of about 10% more than the average amount. With the help of information obtained by tracer experiments on the seasonal variation of groundwater recharge it is now possible to explain the absolute value found for the deuterium content of Central European groundwater. (Knapp-USGS)
W70-10104

THE RELATIONSHIP BETWEEN DISSOLVED NUTRIENT SALTS AND PROTEIN PRODUCTION IN SUBMERGED AUTUMNAL LEAVES,
Waterloo Univ. (Ontario).
H. B. N. Hynes, and N. K. Kaushik.
Verhandlungen Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 95-103, 1969. 3 tab, 17 ref.

Descriptors: *Proteins, *Productivity, *Submerged plants, *Autumn, *Leaves, Organic matter, Aquatic environment, Ecosystems, Nitrogen, Oak trees, Temperature, Phosphates, Decomposing organic matter, Benthic fauna, Maple trees.
Identifiers: *Dissolved nutrient salts, Ulmus americana, Alnus rugosa, Quercus alba, Speed River (Ontario), Hyalella azteca, Microbial activity, Beech, Gammarus lacustris limnaeus, Asellus aquaticus.

Autumn-shed leaves are known to constitute a substantial portion of the ecologically important allochthonous organic matter accumulating in aquatic ecosystems. A study was made to determine whether leaves kept submerged in water and provided with varying quantities of nitrogen from different sources show changes in their nitrogen and protein contents, and whether there is any increase in the absolute quantity of nitrogen. Autumn-shed leaves of elm, alder, and oak were analyzed and changes in mean pecentage weight lost and in protein and nitrogen contents of the elm leaf discs subjected to different treatments are tabulated. Both at 10C and at 20C-22C, the addition of nitrogen to the water in ammonium sulfate form or potassium nitrate enhanced percentage weight lost as compared with controls. Weight loss was generally more pronounced with the addition of phosphate or when the water was enriched with organic nitrogen (Hyalella azteca). As expected, weight loss was accelerated at higher temperatures. The greatest loss of percentage weight was consistently found in elm leaves, and the lowest in alder. Decay rates obviously must be in some way correlated with initial composition. (Jones-Wisconsin)
W70-10163

ANNUAL CYCLE OF PHYTOPLANKTON AND OF PRIMARY PRODUCTION IN TROPICAL SEAS (IN FRENCH),
Museum National d'Histoire Naturelle, Paris (France). Laboratoire des Peches Outre-Mer.
A. Sournia.
English abstract. Marine Biology, Vol 3, No 4, p 287-303, 1969. 5 fig, 125 ref.

Descriptors: *Phytoplankton, *Primary productivity, *Neritic, *Oceans, Sea water, Gulfs, Hydrologic aspects, Climates, Seasonal, Atlantic Ocean, Indian Ocean, Pacific Ocean, Salinity, Temperature, Tropical regions.
Identifiers: Annual cycles, Tropical seas, Brazilian coast, Caribbean Sea, Gulf of Mexico, Bahamas, Sargasso Sea, Gulf of Mannar, Madagascar coast.

Voluminous literature is reviewed describing biotic features of southern seas delineated by the minimum isotherms of 22C throughout the year. By far the larger part of information is confined to the 'neritic' or 'sea' waters, rather than waters of the oceans. In the neritic waters an annual cycle of the composition and intensity of the primary production is usually observed; the seasonal variations are related to the influence of current, upwelling, and climatic factors, especially monsoons. Information on oceanic waters is too meager to permit generalizations. (Wilde-Wisconsin)
W70-10172

THE QUALITY OF ARIZONA'S DOMESTI AGRICULTURAL, AND INDUSTRIA WATERS,
Arizona Univ., Tucson. Agricultural Experime Station.
For primary bibliographic entry see Field 05A.
W70-10224

QUANTITY AND CHEMICAL QUALITY O LOW FLOW IN THE PRAIRIE DOG TOW FORK RED RIVER NEAR WAYSIDE, TEXA FEBRUARY 6-9, 1968,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W70-10229

SOUTHERN MARYLAND RECORDS O SELECTED WELLS, WATER LEVELS, AN CHEMICAL ANALYSES OF WATER,
Geological Survey, Towson, Md.
For primary bibliographic entry see Field 04B.
W70-10231

COMPARISON OF CHEMICA HYDROGEOLOGY OF THE CARBONAT PENINSULAS OF FLORIDA AND YUCATAN,
Geological Survey, Washington, D.C.
William Back, and Bruce B. Hanshaw.
Journal of Hydrology, Vol 10, No 4, p 330-36 June 1970. 39 p, 15 fig, 5 tab, 28 ref.

Descriptors: *Geochemistry, *Hydrogeolog *Water chemistry, *Florida, Groundwat Aquifers, Leaching, Infiltration, Recharg Discharge (Water), Saline water-freshwater inte faces, Saline water intrusion, Groundwater mov ment.
Identifiers: Yucatan.

Aquifers of the peninsulas of Florida and northe Yucatan are Tertiary marine carbonate formatio showing many lithologic and faunal similarities. addition, the tropical to subtropical climates of t two areas are similar, each having annual rainfall about 1000 to 1500 mm. Despite similarities these fundamental controls, contrasts in t hydrologic and geochemical systems are numero and striking. For example, Florida has many rive Yucatan has none. In Florida, the chemic character of water changes downgradient, wi solution of minerals of the aquifer; in the Yucat no downgradient change exists, and domina processes controlling the chemical character of t water are solution of minerals and simple mixing the fresh water and an underlying body of s water. The differences are due primarily to the la in Yucatan of an upper confining bed hydrolo cally equivalent to the Hawthorn Formation Florida. The Hawthorn cover impedes rechar and confines the artesian water. In the Yucatan t permeability of the entire section is so great th rainfall immediately infiltrates to the water tab and then moves laterally to discharge areas alo the coasts. (Knapp-USGS)
W70-10232

FOSSIL WATER,
Geological Survey, Woods Hole, Mass.
F. T. Manheim.
Oceanus, Vol 15, No 4, p 30-32, July 1970. 3 p fig.

Descriptors: *Bottom sediments, *Salinity, Cor Chemical analysis, On-site investigations, Shi Cruises.
Identifiers: *Black Sea, *Fossil water, Press water, Sediment profile.

Chemical analyses were made from water press from sediment cores collected from the Black S during the scientific data-collecting cruise abo the R. V. Atlantis II in April and May 1969. Sali ty, alkalinity, phosphate, nitrate, ammonia, nitri and silicate determinations were made immedia ly, and other samples were fused in polyethyle pipe or in glass ampules and saved for later detail

nalysis in the laboratory. The work done on board evealed that pore fluids become less salty with epth over nearly the entire Black Sea, probably ecause of the influence of fresher waters incor-orated in the sediments during the glacial periods. he only exception to this occurs on approaching ne Bosporus, where salinities decrease less and less ith depth. A map showing the 'fossil' chlorinity of ne Black Sea sediments at a depth of two meters elow the seabottom is included. (Woodard-SGS)
V70-10234

ITHOLOGIC CONTROLS ON THE DEVELOP-IENT OF SOLUTION POROSITY IN CAR-ONATE AQUIFERS,
ennsylvania State Univ., University Park.
or primary bibliographic entry see Field 02F.
V70-10250

HE POISONING OF ION EXCHANGE IATERIALS BY SURFACE ACTIVE IONS,
ow Chemical Co., Midland, Mich.
or primary bibliographic entry see Field 03A.
V70-10260

YDROGEN BONDING AND POLYWATER IN LAY-WATER SYSTEMS,
urdue Univ., Lafayette, Ind. Dept. of Agronomy.
or primary bibliographic entry see Field 01A.
V70-10278

RGANIC MATTER OF RECENT SEDIMENTS F THE CASPIAN SEA,
nstitute of Geology and Fuel Mineral Processing, Moscow (USSR).
or primary bibliographic entry see Field 02J.
V70-10283

LECTROPHORETIC CLARIFICATION OF VATER,
exas A and M Univ., College Station. Water esources Inst.
or primary bibliographic entry see Field 05D.
V70-10314

UTRIENT REGENERATION IN LAKES AND CEANS,
eorgia Univ., Athens. Dept. of Zoology.
or primary bibliographic entry see Field 05C.
V70-10404

2L. Estuaries

HYSICAL AND MATHEMATICAL MODEL TUDIES OF SURFACE CURRENTS,
Hydraulics Research Station, Wallingford (England).
or primary bibliographic entry see Field 05G.
W70-10206

ATHEMATICAL MODEL TECHNIQUES FOR OASTAL WATERS,
Edinburgh Corp. (Scotland).
For primary bibliographic entry see Field 05G.
W70-10207

CTIVABLE RARE EARTH ELEMENTS ESTUARINE WATER TRACERS,
Stanford Univ., Calif. Dept. of Civil Engineering; and Public Health Service San Francisco, Calif.
For primary bibliographic entry see Field 05A.
W70-10210

COMPARISON OF CHEMICAL HYDROGEOLOGY OF THE CARBONATE PENINSULAS OF FLORIDA AND YUCATAN,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02K.
W70-10232

BOUNDARY SHEAR STRESS IN RIVERS AND ESTUARIES,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W70-10257

SEDIMENTATION IN THE FOREDELTA OF THE VOLGA RIVER,
Astrakhan State Reservation (USSR).
For primary bibliographic entry see Field 02J.
W70-10281

QUANTITATIVE DISTRIBUTION OF SUSPENDED MATTER IN THE CENTRAL AND SOUTHEASTERN PARTS OF THE BALTIC SEA,
Akademiya Nauk SSSR. Institut Okeanologii.
For primary bibliographic entry see Field 02J.
W70-10282

ESTUARINE CLEAN WATER COST-BENEFIT STUDIES,
International Water Pollution Research Conference (5th).
For primary bibliographic entry see Field 05G.
W70-10373

ESTUARINE MEASUREMENTS FOR PRODUCTIVITY AND EVALUATION OF SYSTEM WASTE DISCHARGE EFFECTS,
Texas Univ., Austin.
For primary bibliographic entry see Field 05C.
W70-10401

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

SIMULATION-DECISION AID IN PLANNING DESALTING APPLICATIONS,
Office of Saline Water, Washington, D.C.
John S. Westrope.
Water Resources Bulletin, Vol 6, No 4, p 602-616, July-August 1970. 15 p, 7 fig, 1 tab.

Descriptors: *Simulation analysis, *Water resources development, *Desalination, *Systems analysis, *Optimization, Water management (Applied), Computer programs, Economics, Water costs, Conjunctive use, Mathematical models, Digital computers.
Identifiers: Office of Saline Water.

A simulation system under development is a highly flexible computerized model system for evaluating real economic/technical applicability of desalting to a selected area. The Economic Evaluation Model System (EEMS) was initially conceived during 1968 and the first version was completed in 1969. This system represents the combination of technical, environmental and economic functions into an interrelated system, which allows the user to examine a broad range of water related problems, oriented toward the applicability of desalting as an additional or alternative source of water. (Knapp-USGS)
W70-10075

DEVELOPMENT STUDIES ON THE FLASH DISTILLATION PROCESS,
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
R. A. Tidball, A. N. Rogers, and R. N. Webb.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C, 20402, Price $0.75. US Office of Saline Water Research and Development Progress Report No 562, May 1970. 79 p, 24 fig, 15 tab, 10 ref, 2 append. OSW Contract No 14-01-0001-1279.

Descriptors: *Desalination processes, *Flash distillation, Thermodynamics, Scaling, Pilot plants, Desalination plants, Testing, Research and development.
Identifiers: Multistage Flash Distillation.

Two flash distillation pilot plants were operated at the OSW Test Station: (1) a 16-stage High-temperature Flash Distillation Plant; (2) a 3-stage High-flow Flash Devices Test Plant. In the 16-stage plant, scale formation is given over a range of operating conditions as well as with scale control additives. In addition, preliminary tests were made on ion exchange, fluidized bed, and slurry seeding processes. The 3-stage plant tests cover the simple open interstage orifice under a wide range of operating conditions, plus several of the more promising flash enhancers. Graphs relate non-equilibrium values to the various operating parameters. (Knapp-USGS)
W70-10082

VACUUM-FREEZING VAPOR-COMPRESSION PROCESS: EVALUATION ON BRACKISH WATER,
Fairbanks, Morse and Co., Beloit, Wis.
M. M. Jhawar, and J. H. Fraser.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $0.65. U S Office of Saline Water Research and Development Progress Report No 541, March 1970. 46 p, 16 fig. OSW Contract No 14-01-0001-967.

Descriptors: *Desalination processes, *Pilot plants, *Freezing, Saline water, Sea water, Potable water, Scaling, Chemical precipitation, Water chemistry, Water yield, Water costs.
Identifiers: Vacuum-freezing, Vapor-compression desalination.

The Vacuum-Freezing Vapor-Compression (VFVC) Process was evaluated on high salinity brackish water during the period from February 1968 through December 1969 at Roswell, New Mexico. A 15,000 gpd VFVC test plant is mounted on a mobile trailer. The system was checked out and the unit was operated sucessfully on sea water. In Roswell, tests were conducted to determine the effects of precipitation and scaling on the VFVC Process. A number of tests were carried out with yields of 20% to 80%, and the effluent brine concentration ranging from 2.13% to 8.0%. In the entire range, no significant evidence of precipitation or scaling was noticed. No difficulty was encountered in making 500 ppm potable water. The fresh water had a natural taste. (Knapp-USGS)
W70-10083

STUDY OF SEAWATER DESALTING AS EMERGENCY WATER SUPPLY FOR NEW YORK CITY.
Parsons-Jurden Corp., New York.

For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $2.50. U S Office of Saline Water Research and Development Progress Report No 553, January 1970. 273 p, 57 fig, 18 tab, 73 ref, 2 append. OSW Contract No 14-01-0001-1712.

Descriptors: *Desalination plants, *Design, *New York, Cities, Water supply, Droughts, Water shortage, Water sources, Desalination, Sea water, Water utilization, Municipal water, Urbanization, Water requirements, Water resources development.
Identifiers: *New York City.

The problems involved in the application of desalting to meet the emergency and supplemental water needs of the individual boroughs of the City of New York are discussed. The criteria and controlling factors to be considered in the selection of a suita-

ble site are listed, and conceptual designs for 5-, 10- and 25 MGD module desalting plants are presented. A plant design of a size sufficient to meet the requirements of emergency and supplemental water needs was developed. An economic analysis is made of the costs of product water for 5-, 10- and 25 module plants. Although this report is oriented directly around the requirements of the individual boroughs of New York City, the developed information may be applied to evaluating the feasibility of using the distillation plant for meeting the requirements of a major subdivision of any other metropolitan area. (Knapp-USGS)
W70-10084

DISPOSAL OF BRINE BY SOLAR EVAPORATION: DESIGN CRITERIA,
New Mexico State Univ., Las Cruces.
For primary bibliographic entry see Field 05E.
W70-10085

SALINE GROUNDWATER RESOURCES OF THE RIO GRANDE DRAINAGE BASIN--A PILOT STUDY.
Geological Survey, Albuquerque, N. Mex.

For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $2.00. U S Office of Saline Water Research and Development Progress Report No 560, May 1970. 71 p, 21 fig, 1 tab, 21 ref. OSW Agreement No 14-01-0001-2102.

Descriptors: *Saline water, *Water resources development, *Groundwater, *Texas, *New Mexico, Desalination, Water sources, Hydrogeology.
Identifiers: Saline groundwater.

The saline groundwater resources of the Rio Grande drainage basin of Colorado, New Mexico, and Texas were evaluated for the potential application as feed water for desalting plants. The occurrence of groundwater in the basin is controlled primarily by geologic structure, and secondarily by the stratigraphy and lithology of the aquifers. The Albuquerque, New Mexico, and Brownsville, Texas areas are underlain by aquifers that yield more than 500 gpm of saline water of about 3 g/liter salinity from individual wells. The top of this water-quality unit is approximately 3,000 feet below the land surface at Albuquerque, and 1,500 feet or less at Brownsville. The Capitan reef complex in New Mexico and Texas also would sustain large yields of water. More than 6,500 square miles of the lower Rio Grande, Estancia, Jornada del Muerto, and upper Pecos drainage basins are underlain by water of 10-35 g/liter salinity. Brine, containing more than 35 g/liter dissolved solids, is available in significant quantities in the Tularosa basin. A bibliography containing 273 entries is included. (Knapp-USGS)
W70-10086

RESEARCH AND DEVELOPMENT OF NEW AND IMPROVED CELLULOSE ESTER MEMBRANES,
Aerojet-General Corp., El Monte, Calif.
D. L. Hoernschemeyer, C. W. Saltonstall, O. S. Schaeffler, L. W. Schoellenbach, and A. J. Secchi.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $0.65. U S Office of Saline Water Research and Development Progress Report No 556, August 1970. 63 p, 8 fig, 15 tab, 16 ref, 3 append. OSW Contract No 14-01-0001-2205.

Descriptors: *Membranes, *Membrane processes, *Reverse osmosis, *Desalination apparatus, Desalination processes, Brackish water, Saline water, Thin films.
Identifiers: Cellulose membranes.

Improved brackish-water desalination membranes can be fabricated from cellulose acetate and cellulose acetate methacrylate in a manner very similar to that used to make high retention seawater membranes. All the acetates with a ds between 2.1 and 2.63 can be made to have equivalent osmotic properties. Vastly increased flux, along with greatly improved flux stability has been achieved by cross-linking cellulose acetate methacrylate (CAM) membranes. Salt permeability coefficient is closely related to the cohesive energy of the polymer. (Knapp-USGS)
W70-10087

EVALUATION OF PYRRONES AS MEMBRANES,
Franklin Inst. Research Labs., Philadelphia, Pa.
For primary bibliographic entry see Field 05D.
W70-10125

ANNUAL REPORT (FY 1969) WEBSTER TEST FACILITY AND ELECTRODIALYSIS TEST-BED PLANT, WEBSTER, SOUTH DAKOTA.
Mason-Rust, Louisville, Ky.

For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $1.50. U S Office of Saline Water Research and Development Progress Report No 568, June 1970. 159 p, 41 fig, 19 tab, 4 ref. OSW Contract No 14-01-0001-1802.

Descriptors: *Pilot plants, *Desalination plants, *Electrodialysis, *Reverse osmosis, Membrane processes, Testing, Research and development, Water costs, Desalination processes, Membranes, Cost analysis, Performance.
Identifiers: Webster (SD), Desalination test-bed facilities.

An electrodialysis Test Bed Plant has completed the seventh year of demonstration and development operation. The plant has a production capacity of 325,000 gallons per day. The electrodialysis plant feed water was pretreated for iron removal by Zeolite filtration. Lime softening plus carbon filtration was also used to pretreat the water to remove iron, manganese, bicarbonate alkalinity, some hardness, and water soluble 'organic' materials. Carbon filtration removes most of the anion permeable membrane fouling agents. Problems associated with membranes such as membrane breakage and anion membrane fouling are responsible for high product water costs. If membrane fouling and breakage were not problems, product water costs would be $0.83 per 1,000 gallons (250,000 GPD, 330 days on stream). Pilot plant development programs at Webster were in: (1) high temperature electrodialysis, (2) evaluation of membranes for electrodialysis and transport depletion, and (3) reverse osmosis. (Knapp-USGS)
W70-10258

FORCED-FLOW ELECTRODESALINATION,
Southern Research Inst., Birmingham, Ala.
Thomas A. Davis, and Robert E. Lacey.
For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $1.00. U S Office of Saline Water Research and Development Progress Report No 557, July 1970. 93 p, 26 fig, 17 tab, 9 ref, 5 append. OSW Contract No 14-01-0001-1167.

Descriptors: *Electrodialysis, *Desalination processes, Membrane processes, Flow, Boundary processes, Model studies, Mathematical models, Testing, Research and development, Dialysis, Pilot plants, Electrochemistry, Desalination, Membranes.
Identifiers: *Forced-flow electrodesalination.

Forced-flow electrodesalination (FFED) utilizes high-shear flow through thin solution compartments to reduce concentration polarization. In electrodialysis of natural brackish waters, precipitation of pH sensitive salts within the stack as a result of concentration polarization usually limits the operating current density to a value well below the economic optimum current density. With the thin solution compartments and high solution velocities of FFED, high values of limiting current density can be obtained. Cell-pair resistance also lower with the thin solution compartmen Costs of treatment of brackish waters by FFED a estimated to be about 25% less than costs of tre ment by conventional electrodialysis. A system equations was developed to describe the operati of the FFED stack. With these equations, t operating conditions, energy consumption, a production rate of a given FFED stack can be p dicted. (Knapp-USGS)
W70-10259

THE POISONING OF ION EXCHANG MATERIALS BY SURFACE ACTIVE IONS,
Dow Chemical Co., Midland, Mich.
Hamish Small, and Robert C. Gardner.
For sale by the Superintendent of Documents, U Government Printing Office, Washington, D 20402 - Price $0.70. U S Office of Saline Wat Research and Development Progress Report 565, August 1970. 71 p, 22 fig, 4 ref, 2 appen OSW Contract No 14-01-0001-2158.

Descriptors: *Membrane processes, *Desalinati processes, *Ion exchange, *Surfactants, Me branes, Permeability, Resins, Semipermeable me branes, Inhibitors.
Identifiers: Membrane poisoning.

An experimental study was made of how the rate a simple ion exchange reaction is influenced by t presence of surface active ions in both resin a membrane systems. Ion exchange membra poisoning results from the formation of barri layers, which are sparsely populated by mobile ca riers, the majority of the sites being occupied sluggish, tightly bound poison ions. Exposure of i exchanging materials to even very low levels of su factants can lead to poisoning. Significant poiso ing effects were noted when the level of surfacta was about 1/1000 M. Protection for the exchang could be derived by providing for as high a degr of cross-linking as possible. This would tend prevent the accretion of large poisoning ions in t exchanger purely on a kinetic basis. Alcohols a effective, with their effectiveness increasing their nonpolar character increases. A nonionic su face active agent was effective in neutralizing t poisoning effect of surfactants. (Knapp-USGS)
W70-10260

VERTICAL TUBE EVAPORATION UTILIZIN VORTEX FLOW AND INTERFACE ENHANC MENT,
California Univ., Berkeley. Sea Water Conversi Lab.
Hugo H. Sephton.
For sale by the Superintendent of Documents, U. Government Printing Office, Washington, D. 20402. Price $0.75. Office of Saline Wat Research and Development Progress Report 57 May 1970. 81 p, 36 fig, 7 ref. OSW Contract 14-0 0001-1744.

Descriptors: *Research and development, *Risi film evaporation, *Falling film evaporation, *He transfer improvements, *Vortex tube process, *I terface enhancement process, *Surfactant ad tives, *Twisted tubes, Proprietary processes, Foa ing agents, OSW sponsored investigation.

The purpose of this study is to test pairs of full siz distillation tubes in vertical mode to provide co parative data from upflow and downflow modes operation. Double-fluted and spiral-corrugat distillation tubes were tested with fresh water, bri and sea water feed in both the upflow a downflow mode. Two novel, proprietary metho of brine side enhancement were applied: the Vo tex Tube process and the Interface Enhanceme method. The latter method in upflow mode w emphasized in this work. It depends upon the ad tion of selected surfactants to the feed brine in few parts per million concentrating and up establishing a foamy two-phase flow condition ov the heat transfer surface. Over-all heat transf

enhancements of about 100 percent was reproducibly demonstrated under realistic upflow VTE conditions with both double-fluted and spiral-corrugated distillation tubes using sea water feed having 6 ppm of a fully biodegradable commercial surfactant added thereto at a cost of $12 per 1.5 million gallons of sea water treated or 6 cents/1000 gallons. (Pruett-Office of Saline Water)
W70-10317

DEMINERALIZATION OF WASTE WATER BY ION EXCHANGE,
Los Angeles County Sanitation District, Calif.; and Federal Water Pollution Control Administration, Cincinnati, Ohio.
For primary bibliographic entry see Field 05D.
W70-10400

3B. Water Yield Improvement

OPTIMAL PLANNING OF A COASTAL COLLECTOR,
Technion-Israel Inst. of Tech., Haifa; and Water Planning for Israel Ltd., Tel-aviv.
For primary bibliographic entry see Field 02F.
W70-10053

OPTIMUM OPERATING PROCEDURE FOR A RIVER GAGING STATION ESTABLISHED TO PROVIDE DATA FOR DESIGN OF A WATER SUPPLY PROJECT,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 07A.
W70-10057

EVAPOTRANSPIRATION BY WOODY PHREATOPHYTES IN THE HUMBOLDT RIVER VALLEY, NEAR WINNEMUCCA, NEVADA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02D.
W70-10243

EMPIRICAL RELATIONS IN PROPERTIES OF UNCONSOLIDATED QUARTZ SANDS AND SILTS PERTAINING TO WATER FLOW,
Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia); and Australian Atomic Energy Commission Research Establishment, Lucas Heights.
For primary bibliographic entry see Field 02F.
W70-10245

STREAMFLOW CHANGES AFTER FOREST CLEARING IN NEW ENGLAND,
Forest Service (USDA), Durham, N. H. Northeastern Forest Experiment Station.
J. W. Hornbeck, R. S. Pierce, and C. A. Federer.
Water Resources Research, Vol 6, No 4, p 1124-1132, August 1970. 9 p, 3 fig, 3 tab, 15 ref.

Descriptors: *Water yield improvement, *Clear-cutting, Forest management, Land clearing, Watershed management, Water yield, Rainfall-runoff relationships, Snowmelt, Hydrograph analysis, Infiltration.
Identifiers: Hubbard Brook Experimental Watershed (NH).

Clearing a hardwood forest cover and preventing regrowth with herbicides on a 39-acre watershed in central New England increased annual water yield an average 12.2 area-inches for the first two water years after treatment. Most of this increase occurred during the critical low flow months of June through September, and the amount was governed in large part by rainfall in this period. There was a small advance of snowmelt runoff and a consistent increase in growing season high flow values. Sizeable streamflow increases can result from forest clearing in the uplands of the eastern United States. (Knapp-USGS)
W70-10249

3C. Use of Water of Impaired Quality

PHYSIOLOGICAL RESPONSES OF PLANTS TO SALINITY: PLANT-WATER RELATIONS,
Arizona Univ., Tucson. Environmental Research Lab.
For primary bibliographic entry see Field 02I.
W70-10306

3D. Conservation in Domestic and Municipal Use

CITY OF CORAL GABLES V CRANDON (CONSTITUTIONALITY OF STATUTE ESTABLISHING WATER CONSERVATION DISTRICTS).
For primary bibliographic entry see Field 06E.
W70-10348

THE FULL-SCALE RECLAMATION OF PURIFIED SEWAGE EFFLUENT FOR THE AUGMENTATION OF THE DOMESTIC SUPPLIES OF THE CITY OF WINDHOEK,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 05D.
W70-10381

3E. Conservation in Industry

SOME ECONOMIC ASPECTS OF WATER REUSE IN CZECHOSLOVAKIA,
International Water Pollution Research Conference (5th).
For primary bibliographic entry see Field 05D.
W70-10372

NIAGARA FALLS POWER CO V FEDERAL POWER COMM'N (DIVERSION OF WATER FROM RIVER BY POWER COMPANY).
For primary bibliographic entry see Field 06E.
W70-10458

3F. Conservation in Agriculture

LINEAR PROGRAMMING MODELS FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 06D.
W70-10055

FACTORS AFFECTING DETERMINATION OF IRRIGATION WATER REQUIREMENTS,
California State Dept. of Water Resources, Sacramento.
John W. Shannon, and Norman MacGillivray.
7th Congr Irrig Drain, Quest 23, Rep Disc, Part 2, R24-R45, Mexico City, p 23.559-23.568, 1969. 11 p, 2 fig, 1 tab, 8 ref.

Descriptors: Irrigation, *Water requirements, Evapotranspiration, Soil moisture, Consumptive use, Crops, Root systems, Root zone, Forecasting, Plant physiology, *Irrigation efficiency, *Irrigation water, Estimating, *Irrigation operation and maintenance, *Irrigation practices, Roughness, Climates.
Identifiers: *Irrigation requirement, Ground cover, Tulare Lake Basin, Calif, Soil moisture storage, California Department of Water Res.

The California Department of Water Resources is conducting field studies to obtain data upon which reasonable estimates of irrigation water requirements may be based. Observations and data collected in the valley floor portion of the Tulare Lake Basin typify results obtained state-wide and are used to illustrate factors considered in estimating irrigation requirements. Although considerable emphasis has been placed on precise determination of evapotranspiration in research studies throughout the world in recent years, other factors of equal importance that have been neglected are: storage and use of available soil moisture accruing from rainfall and irrigation, and actual and achievable irrigation efficiencies. While these factors are interrelated, some physical factors influencing them are discussed in the light of Department of Water Resources field studies. The approach for estimating irrigation water requirements, in which all the above-listed factors are considered, is based upon a soil moisture-budgeting procedure. An example illustrates how one crop, having a deeper rooting pattern, may use excess moisture that was applied to a preceding shallow-rooted crop. (USBR)
W70-10134

ULTRASONIC FLOWMETER,
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 04A.
W70-10139

IRRIGATION REQUIREMENTS FROM EVAPORATION,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 02D.
W70-10141

AUTOMATIC MECHANICAL IRRIGATION GATES,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
For primary bibliographic entry see Field 08C.
W70-10145

POST-IRRIGATION MOVEMENT OF SOIL WATER 2. SIMULTANEOUS REDISTRIBUTION AND EVAPORATION,
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02G.
W70-10247

WATER RELATIONS OF MAIZE: PART 1. - EFFECTS OF SEVERE SOIL MOISTURE STRESS IMPOSED AT DIFFERENT STAGES OF GROWTH ON GRAIN YIELDS OF MAIZE,
Rhodesia Dept. of Research and Specialist Services, Salisbury.
J. H. Wilson.
Rhodesian Journal of Agricultural Research, Vol 6, No 2, p 103-105, 1968. 2 tab, 3 ref.

Descriptors: *Corn (Field), *Growth stages, *Moisture stress, *Crop response, *Crop production, Drought, Arid lands, Semiarid climates, Soil moisture, Soil water, Irrigation, Irrigation effects, Environmental effects, Plant physiology, Plant growth, Flowering, Leaves, Grains (Crops), Soil-water-plant relationships.
Identifiers: *Rhodesia, Soil matric potential.

A study was undertaken at Salisbury, Rhodesia, in which corn was grown outdoors in soil-filled polyethylene bags. Rainfall influence on the study was prevented by clamping the bags around the base of the stalk. Irrigation held the soil matric potential above -2.0 atm except during 5 stages of growth or various combinations of these stages. At such time, irrigation was withheld and severe soil moisture stress developed until soil matric potential fell below -15.0 atm for 8 days. These drought periods occurred at the eight leaf stage, silking, and early, middle, and late grain-development stages. Drought before flowering lengthened the duration of leaves, but drought after flowering caused premature leaf aging. Number of grains per plant was reduced by up to 32 percent if drought occurred between late vegetative and early grain development stages and by up to 49 percent if drought came after flowering. Two or more consecutive

droughts during the late vegetative and early reproductive phases caused as much as 66 percent yield reduction. (See also W70-10290) (Carr-Arizona)
W70-10289

WATER RELATIONS OF MAIZE: PART 2. - THE EFFECTS OF NINE IRRIGATION REGIMES ON MAIZE,
Rhodesia Dept. of Research and Specialist Services, Salisbury.
J. H. Wilson.
Rhodesian Journal of Agricultural Research, Vol 6, No 2, p 107-108, 1968. 2 tab, 1 ref.

Descriptors: *Corn (Field), *Growth stages, *Moisture stress, *Crop response, *Crop production, Drought, Arid lands, Semiarid climates, Soil moisture, Irrigation, Irrigation effects, Environmental effects, Soil water, Plant physiology, Plant growth, Flowering, Leaves, Grains (Crops), Soil-water-plant relationships.
Identifiers: *Rhodesia, Soil matric potential.

Corn was grown in Rhodesia under wet, medium, and dry soil water regimes. Under these regimes, soil matric potential was allowed to fall to -2.0, -15.0, and less than -15.0 atm, respectively, before irrigation. Varying combinations of regimes were imposed, one before and one after silking. Drought before flowering delayed tasselling and silking and caused a decrease in number of grain. However, water regime before flowering was not nearly so important as water regime after flowering. As long as plants were well watered after flowering, heavier grain compensated for any decrease in number of grain. Leaves endured longer if watered infrequently before flowering and generously afterwards. In contrast, leaf aging was 3 to 4 weeks premature when plants were watered sparingly during the reproductive phase. (See also W70-10289) (Carr-Arizona)
W70-10290

EFFECTS OF SIMULATED GRAZING ON SOIL MOISTURE CONTENT IN MID-ELEVATION RESEEDED RANGELAND,
Utah State Univ., Logan.
John C. Buckhouse, and George B. Coltharp.
Utah Academy of Sciences, Arts, and Letters, Proceedings, Vol 45, pt 1, p 211-219, 1968. 3 fig, 4 tab, 9 ref.

Descriptors: *Grazing, *Range management, *Soil moisture, *Moisture content, *Water yield, Semiarid climates, Livestock, Ranges, Carrying capacity, Grasslands, Forages, Alfalfa, Wheatgrasses, Water conservation, Utah.
Identifiers: *Simulated grazing, *Grazing effects, *Reseeding.

In 1966 and 1967 a range plant clipping study was undertaken on an established stand of crested wheatgrass (Agropyron cristatum) and alfalfa (Medicago sativa) at Major's Flat, Utah. In 1965 27 circular plots were fenced and randomly assigned to one of 9 treatment schemes. Soil moisture on each plot was measured by a neutron meter through a soil moisture access tube. The study showed that, when compared with control conditions, significantly less soil moisture was withdrawn under extreme clipping treatments. Less intense clipping also resulted in reduced soil moisture withdrawal, although occasionally the differences were not statistically significant. On mid-elevation ranges heavy grazing apparently increases water yield, but such problems as flooding and decreased water quality may occur. This would seem to indicate that forage removal between the extremes of control conditions and complete denudation would yield the most benefits of increased livestock use and increased water yield. However, until the effects of trampling are studied, direct implications cannot be drawn between this experiment and absolute soil moisture response to livestock grazing. (Carr-Arizona)
W70-10291

A HYDROLOGIC BUDGET FOR A SOUTHERN ALBERTA IRRIGATION DISTRICT,
Department of Agriculture, Lethbridge (Alberta). Research Station; and Alberta Univ., Edmonton. Dept. of Agricultural Engineering.
E. Rapp, J. C. van Schaik, and N. N. Khanal.
Canadian Agricultural Engineering, Vol 11, No 2, p 54-57, November 1969. 2 fig, 3 tab, 11 ref.

Descriptors: *Hydrologic budget, *Hydrologic data, *Irrigation water, *Irrigation districts, *Water distribution (Applied), Water management (Applied), Analysis, Semiarid climates, Irrigation, Irrigation programs, Irrigation efficiency, Irrigation practices, Efficiencies, Water requirements, Diversion, Precipitation (Atmospheric), Water conveyance, Consumptive use, Diversion losses, Water loss.
Identifiers: *Alberta (Canada), *Bow River Project, Gross diversion, Farm losses, Irrigation factor, Conveyance efficiency.

The Vauxhall District of the Bow River Project in Southern Alberta, Canada, was studied from 1958 to 1968 in order to obtain data on the various components of a hydrologic budget for the area. During the 10-year study period, gross diversion was 74% and seasonal precipitation was 26% of the total items of supply. On the other side of the budget, consumptive water requirement was 54%, diversion losses 26%, and farm losses 20%. These figures yielded an average irrigation factor of 63%, water conveyance efficiency of 65%, farm irrigation efficiency of 58%, and overall efficiency of 38%. Highly significant correlations were obtained between seasonal rainfall and irrigation factor, between seasonal rainfall and gross diversion per irrigable acre, and between gross diversion and farm and diversion losses. Data analysis such as this is useful when assessing water allocation or estimating water needs on existing or proposed irrigation projects. (Carr-Arizona)
W70-10298

THE ECOLOGICAL BACKGROUND TO LAND-USE STUDIES IN TROPICAL AFRICA, WITH SPECIAL REFERENCE TO THE WEST,
Birmingham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02I.
W70-10309

POPULATION DENSITY AND AGRICULTURAL SYSTEMS IN WEST AFRICA,
Salford Univ. (England). Dept. of Geography.
M. B. Gleave, and H. P. White.
In: Environment and Land Use in Africa, Chapter 10, p 273-299, Methuen, London, 1969. 2 tab, 70 ref.

Descriptors: *Land use, *Fallowing, *Cultivation, *Population, *Economic efficiency, Grazing, Social impact, Social values, Tropical regions, Semiarid climates, Ecology, Rain forests, Grasslands, Agriculture, Land management, Density.
Identifiers: *West Africa, *Intensive agriculture, *Extensive agriculture, *Agricultural evolution.

The effects of increasing African populations are explored in relation to their impacts on existing agricultural systems. In West Africa, 3 types of agriculture and their corresponding social effects may be distinguished: (1) shifting agriculture, occurring in relatively arid areas of low population densities and characterized by long periods of bush fallow and periodic land redistribution by the clan or family group; (2) rotational bush fallowing where land and water rights are maintained by the family or individual; (3) semi-permanent cultivation with intensive agricultural methods and the sharp diminution or disappearance of fallow periods. The land-use categories are roughly parallel with increasing population densities. However, man-land relationships do not always hold at high densities because of labor shifts into non-agricultural sectors. The agricultural categories are also roughly concurrent with the land-use stages of (1) ecological balance, (2) soil exhaustion, (3) soil and water conservation. It is suggested that in land-use studies, diagnoses of population densities are less critical than identification of the transitional periods from rotational bush fallowing to permanent cultivation. (Casey-Arizona)
W70-10310

MAN-WATER RELATIONS IN THE EAST CENTRAL SUDAN,
Birbeck Coll., London (England). Dept. of Geography.
For primary bibliographic entry see Field 06G.
W70-10311

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN 2. PERFORMANCE OPTIMIZATION,
Cornell Univ., Ithaca, N.Y.; and Geological Survey, Arlington, Va.
For primary bibliographic entry see Field 06A.
W70-10054

APPLICATION OF LINEAR RANDOM MODELS TO FOUR ANNUAL STREAMFLOW SERIES,
Alaska Univ., College; and Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02A.
W70-10069

RADIOMETRIC METHOD OF SEEPAGE CONTROL IN DAMS AND THEIR ENVIRONS (RUSSIAN),
Polish Academy of Science, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 07B.
W70-10105

LOCALIZATION OF LEAKAGES FROM A LARGE RESERVOIR, USING RADIOACTIVE TRACERS (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleares.
For primary bibliographic entry see Field 07B.
W70-10110

THE STORAGE COEFFICIENT AS A FUNCTION OF WATER TABLE CELERITY,
Washington State Univ., Pullman. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02F.
W70-10119

STEINLE V CITY OF CINCINNATI (CITY'S LIABILITY FOR SUBSIDENCE DAMAGE CAUSED BY LEAKING SEWERS).
For primary bibliographic entry see Field 06E.
W70-10138

ULTRASONIC FLOWMETER,
Public Works Research Inst., Tokyo (Japan).
Takeo Kinosita.
Seventh Congress on Irrigation Drainage, Quest 24, Rep Disc, R1-R24, Mexicao City, p 24.307-24.318, 1969. 14 p, 11 fig, 2 tab.

Descriptors: *Flow measurement, *Flowmeters, *Ultrasonics, Field tests, Water management (Applied), Electronic equipment, Transducers, Velocity distribution, Laboratory tests, Foreign research, Velocity, Research and development, Measuring instruments, Instrumentation, *Discharge measurement, *Water measurement.

Identifiers: *Ultrasonic flow measurement, Test results, Japan, *Sing around system.

Flow measurement is an important procedure for water management, and is very important in irrigation and drainage. The ultrasound method of measuring flow is discussed. The 5 different kinds of ultrasonic systems available for flow measurement are: (1) beam deflection, (2) phase comparison, (3) pulse transit, (4) sing around, and (5) Doppler. Systems (1), (2), (3), and (5) need correction of the ultrasonic velocity that depends upon water temperature, density, and pressure. System (4) has no relation to the ultrasonic velocity, and is reviewed. The basic idea of the sing around system, the application to flow measurement, and use when velocity distribution is not uniform are examined. A preliminary experiment in flow measurement was performed in the laboratory prior to a field installation in a drainage channel. Results of the field installation indicated that measurement of mean velocity by ultrasound agreed well with a Price meter. (USBR)
W70-10139

BREAKING THE ICE BARRIER - A REPORT ON A DRAMATIC MISSION THAT LEARNED IT CAN BE DONE,
Saint Lawrence Seaway Development Corp.
George E. Wilson.
Seaway Review, Vol 1, No 1, p 19-22, 26, Spring 1970. 5 fig.

Descriptors: *Ice breakup, *Navigation, Economic feasibility, *St. Lawrence seaway.
Identifiers: Finncarrier, Michigan's Upper Peninsula, Baltic Sea.

The economic feasibility of and technological capacity for keeping the St. Lawrence Seaway navigable throughout the year are examined in this paper. At the present time the Seaway is impassable during several winter months because of ice conditions. Ice breaking operations on the Baltic Sea, which provide for year-round transportation of commerce, were observed by an investigative mission from the Seaway area. This article lists several reasons why similar ice breaking operations should be instituted for the Seaway. The costs of transportation on the Great Lakes would be reduced with year-round navigation; Michigan's iron mines are losing business to foreign competitors who have year-round access to the Eastern Seaboard; and Great Lakes ship builders are unable to bid for contracts which require delivery during winter. (Holmes-Rutgers)
W70-10179

RYDER V TOWN OF LEXINGTON (CITY'S LIABILITY FOR WATER DAMAGE CAUSED BY DRAINAGE WATER OVERLOAD OF STREAM).
For primary bibliographic entry see Field 06E.
W70-10214

ADAMS V TOWN OF RUSTON (ACCELERATED EROSION OF NATURAL STREAM BY DISCHARGE OF SWIMMING POOL WATER).
For primary bibliographic entry see Field 02E.
W70-10216

MEKONG DELTA MATHEMATICAL MODEL PROGRAM CONSTRUCTION,
Bologna Univ. (Italy); and Societe Grenobloise d'Etude et d'Applications Hydrauliques (France).
Dino Zanobetti, Henri Lorgere, Alexandre Preissmann, and Jean Andre Cunge.
ASCE Proceedings, Journal of the Waterways and Harbors Division, Vol 96, No WW2, Paper 7259, p 181l-199, May 1970. 19 p, 8 fig, 4 tab, 8 ref, append.

Descriptors: *Deltas, *Flood control, *Reservoirs, *Mathematical models, *Computer programs, Systems analysis, Model studies, Computer models, Digital computers, Routing, Water levels, Stage-discharge relations, Dams.
Identifiers: *Cambodia, *Vietnam, *Mekong River, Tonle Sap.

Control of the flood which periodically inundates 50,000 sq km in the Lower Basin of the Mekong river in Cambodia and South Vietnam is proposed by means of a barrage across the Tonle Sap. This would transform the Great Lake of Cambodia into a 72 billion cu m reservoir. A model of the system consists of a system of ordinary first order differential equations each representing water level as a function of time in one of the some 300 meshes into which the area is divided. Exchange relations between cells are based on Saint Venant's dynamic equations or on the weir type exchange laws, inertia terms being ignored in both cases due to the very small velocity of flood propagation. Boundary conditions are represented by about 50 additional imaginary cells. A flood lasting 3.5 months corresponds to about 120 computation cycles with a time increment varying between 6 hr and 48 hr. It requires about 1 hr of computer time. Printout is done by means of the IBM 1401. (Knapp-USGS)
W70-10264

FLOOD PLAIN INFORMATION, EAST FORK SAN JACINTO RIVER, REESE AND TARKINGTON BAYOUS, CLEVELAND, TEXAS.
Corps of Engineers, Galveston, Tex.

US Army Corps of Engineers Flood Plain Report, June 1970. 41 p, 5 fig, 14 plate, 13 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood.
Identifiers: *San Jacinto River (Tex), Cleveland (Tex), Standard project flood, Intermediate regional flood.

Flooding of the East Fork San Jacinto River, Cleveland, Texas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-10275

FLOOD PLAIN INFORMATION, PASCAGOULA - GAUTIER COASTAL AREA, JACKSON COUNTY, MISSISSIPPI.
Corps of Engineers, Mobile, Ala.

US Army Corps of Engineers Flood Plain Report, June 1970. 31 p, 7 fig, 15 plate, 3 tab.

Descriptors: *Floods, *Flood damage, *Mississippi, Flood plains, Flood control, Non-structural alternatives, Maximum probable flood, Hurricanes, Rainfall, Storm runoff, Historic flood.
Identifiers: Jackson County (Miss).

Flooding of the Pascagoula-Gautier Coastal area, Jackson County, Mississippi is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W70-10276

BENSON V CITY OF ANDALUSIA (CONSTITUTIONALITY OF ORDINANCE FOR OPERATION OF CITY SEWAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W70-10299

EMERY V ORLEANS LEVEE BD (DEDICATION OF STATE PROPERTY VIA ACT AUTHORIZING PROJECT CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-10359

DOES BEDDING PROMOTE PINE SURVIVAL AND GROWTH ON DITCHED WET SANDS.
Forest Service (USDA), Charleston, S. C. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 02I.
W70-10409

FILTROL CORP V HUGHES (REASONABLE USE OF LAND AFFECTING SURFACE RUNOFF).
For primary bibliographic entry see Field 06E.
W70-10420

MILLER V UNITED STATES (EVALUATION OF LAND CONDEMNED BY UNITED STATES).

137 F2d 592-596 (3rd Cir 1943).

Descriptors: *Pennsylvania, *Compensation, *Condemnation value, *Condemnation, Eminent domain, Federal government, Judicial decisions, Legal aspects, Riparian land, Value, Market value, Property values, Appraisals, Evaluation, Damages, Damsites, Dams, Reservoir storage, Flood control, Impounded waters, Impoundments, Drainage, Mine drainage.

Plaintiff brought action to recover severance damages for land taken under condemnation proceedings by the United States. The land had been condemned for the purpose of constructing a dam and reservoir in conjunction with a flood control project. Plaintiff contended that the water impounded by the dam would create a mental hazard which would decrease the value of his remaining property. Defendant contended that the danger of floods below the dam would be greatly decreased by the project. Plaintiff made no attempt to prove the dam was improperly constructed, that water would overflow barriers constructed by defendant or that the dam would add to the normal drainage problems present in the area. Furthermore, only a small amount of water was impounded behind defendant's dam. Therefore, the testimony as to the alleged mental hazard created by the dam and impounded waters was properly excluded below. The judgment for defendant was affirmed. (Price-Florida)
W70-10428

UNITED STATES V CHICAGO BURLINGTON AND QUINCY RR (RECOVERY OF DAMAGES PROXIMATELY CAUSED BY DAM CONSTRUCTION).
For primary bibliographic entry see Field 06E.
W70-10430

CAMDEN SEWER CO V MAYOR AND COUNCIL (USE OF SEWERS IN SURFACE WATER DRAINAGE).
For primary bibliographic entry see Field 06E.
W70-10446

ALOTTO V CITY OF CORNING (CAUSE OF ACTION FOR CONTINUING WATER DAMAGE).
For primary bibliographic entry see Field 06E.
W70-10450

MORETTI V VILLAGE OF PEEKSKILL (DIVERSION OF STREAMFLOW).
For primary bibliographic entry see Field 06E.
W70-10451

ELDRED DRAINAGE AND LEVEE DIST V WILCOXSON (DRAINAGE DISTRICT'S AUTHORITY TO LEVY AN ASSESSMENT TO PAY A JUDGMENT FOR DAMAGES).
For primary bibliographic entry see Field 06E.
W70-10456

HEID V ALLEGHENY COUNTY (DAMAGES FROM DIVERSION OF SURFACE WATER FLOW BY HIGHWAY IMPROVEMENTS).
For primary bibliographic entry see Field 06E.
W70-10465

LUCAS V CITY OF LOUISIANA (FLOOD DAMAGE CAUSED BY CITY'S NEGLIGENT FAILURE TO REMOVE OBSTRUCTION IN STREAM).
For primary bibliographic entry see Field 06E.
W70-10469

CITY OF LOUISVILLE V COPE (LIABILITY FOR FLOOD DAMAGE CAUSED BY WATER BACKING UP FROM CITY'S STORM DRAIN).
For primary bibliographic entry see Field 06E.
W70-10470

TESENEER V HENRIETTA MILLS CO (RIGHT TO RECOVER PERMANENT DAMAGES FOR NEGLIGENT OPERATION DAM).
For primary bibliographic entry see Field 06E.
W70-10473

SOUTHLAND COFFEE CO V CITY OF MACON (LIABILITY FOR DAMAGES RESULTING FROM EXTRAORDINARY RAINFALL).
For primary bibliographic entry see Field 06E.
W70-10476

JOHNSTON V CITY OF ATLANTA (MUNICIPALITY NOT LIABLE FOR ERROR OF JUDGMENT IN SEWER SYSTEM PLANNING).
For primary bibliographic entry see Field 06E.
W70-10477

HASER V ALLEGHENY COUNTY (CONDEMNATION PROCEEDING TO CHANGE LOCATION OF A CREEK BED).
For primary bibliographic entry see Field 06E.
W70-10478

NICHOLS V CITY OF MORRISTOWN (LIABILITY FOR INJURY DUE TO INADEQUACY OF CREEK TO ACCOMMODATE SURFACE WATER).
For primary bibliographic entry see Field 02E.
W70-10483

CIMINELLI V LIBURDI (FLOOD DAMAGE RESULTING FROM GRADE CHANGE BY ADJOINING LANDOWNERS).
For primary bibliographic entry see Field 06E.
W70-10485

CULLEY V HOLLIS (RIGHTS OF OWNERS OF LAND ABUTTING NAVIGABLE STREAMS TO ERECT IMPROVEMENTS IN SUCH STREAMS).
For primary bibliographic entry see Field 06E.
W70-10495

LEARY V CITY OF MANCHESTER (LIABILITY FOR NUISANCE CREATED BY FAILURE TO PROPERLY MAINTAIN DRAINAGE DITCH).
For primary bibliographic entry see Field 06E.
W70-10499

ROONEY V MILLSTONE TP (DAMAGES FROM DISCHARGE OF SURFACE WATER DRAINAGE).
For primary bibliographic entry see Field 06E.
W70-10500

4B. Groundwater Management

MODEL STUDIES OF TIDAL EFFECTS ON GROUNDWATER HYDRAULICS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 02F.
W70-10034

GROUNDWATER LEVELS IN NEBRASKA,
Geological Survey, Lincoln, Nebr.
C. F. Keech.
Nebraska Water Survey Paper 26, May 1970. 83 p, 8 fig, 1 tab.

Descriptors: *Water levels, *Groundwater, *Hydrologic data, *Nebraska, Data collection, Monitoring, Observation wells, Water wells, Water level fluctuations, Irrigation water, Water utilization, Evapotranspiration.
Identifiers: Groundwater data.

This report contains measurements made in selected wells, in Nebraska strategically located to indicate net water-level changes. All the important aquifers are represented by at least one observation well. Except for a few measurements and the 50 recording gages that continually monitor water-level fluctuations in the well, water levels are obtained in the fall, several weeks after the close of the irrigation season. Of the 33,791 registered irrigation wells, 1,361 were registered during 1969 with the Nebraska Department of Water Resources. Only 35 of the 93 counties in the State ended the 1969 year with average water levels in wells lower than the fall of 1968. Most western counties were drier than normal. (Knapp-USGS)
W70-10071

HOW MUCH UNDERGROUND WATER STORAGE CAPACITY DOES TEXAS HAVE,
Texas Water Development Board, Austin. Groundwater Div.
Gunnar Brune.
Water Resources Bulletin, Vol 6, No 4, p 588-601, July-August, 1970. 14 p, 7 fig, 2 tab, 20 ref.

Descriptors: *Water storage, *Aquifers, *Texas, *Inter-basin transfers, Water conveyance, Water resources development, Water transfer, Planning, Water levels, Drawdown, Evapotranspiration, Artificial recharge, Injection wells, Conjunctive use.
Identifiers: Texas Water Plan.

Water imported into Texas under the Texas Water Plan must be stored in surface or underground reservoirs. Groundwater levels are being drawn down heavily in many parts of Texas. This is causing a shift of much water from a surface water to a groundwater environment. The lowering water tables have resulted in a great reduction in wastage of water through evapotranspiration and spring and well flow. The methods used in estimating the quantities of underground storage capacity available in Texas are discussed. Some problems will be encountered in the use of dewatered underground storage capacity by artificial recharge. In spite of these problems, probably 60 to 70% of the dewatered storage capacity of Texas aquifers can be reused for groundwater storage. Most of this capacity is located where it can be used in conjunction with the Texas Water Plan. (Knapp-USGS)
W70-10081

OXYGEN-18 AND TRITIUM IN THE EVIAN BASIN (FRENCH),
Geodynamics Investigation Center, Paris (France).
For primary bibliographic entry see Field 02K.
W70-10095

SOUTHERN MARYLAND RECORDS OF SELECTED WELLS, WATER LEVELS, AND CHEMICAL ANALYSES OF WATER,
Geological Survey, Towson, Md.
James M. Weigle, and Wayne E. Webb.
Maryland Geological Survey Basic Data Report No 4, 1970. 48 p, 1 fig, 4 plate, 5 tab, 5 ref.

Descriptors: *Water wells, *Data collections, *Water levels, *Groundwater, *Maryland, Surveys, Investigations, Hydrologic data, Geology, Hydrogeology, Water quality, Water supply, Aquifers, Observation wells.
Identifiers: Calvert County (Md), Charles County (Md), St. Marys County (Md).

This report presents basic data collected as part of a study of water resources in southern Maryland by the U. S. Geological Survey in cooperation with the Maryland Geological Survey. Included in the area investigated are Calvert, Charles, and St. Marys Counties--1044 square miles of land area limited on the east by Chesapeake Bay and on the southwest by the Potomac River. The data in this report include records of about 424 wells and test holes, chemical analyses of water from 150 wells and 13 stream sites, and hydrographs based on periodic measurements of water levels in 17 wells. Drillers' logs are available for many wells. Geophysical logs (gamma and/or electric) are available for some wells. Hydrographs show water-level changes in observation wells in Calvert, Charles, and St. Marys Counties and southernmost Prince Georges County for their periods of record. The corresponding water-level measurements for those periods are available, and the wells at which the measurements were made are described. (Knapp-USGS)
W70-10231

HYDROGEOLOGIC DATA FOR THE LOWER HOUSATONIC RIVER BASIN, CONNECTICUT,
Geological Survey, Hartford, Conn.
I. G. Grossman, and William E. Wilson.
Connecticut Water Resources Bulletin No 20, 1970. 50 p, 2 fig, 1 plate, 5 tab, 14 ref.

Descriptors: *Hydrologic data, *Water wells, *Streamflow, *Connecticut, *Data collections, Hydrogeology, Water levels, Aquifers, Water quality, Geology, Publications.
Identifiers: Housatonic River basin (Conn).

Hydrologic and geologic data collected for an investigation of the lower Housatonic River basin by the U. S. Geological Survey are presented. The basic-data report can be used for detailed information needed in planning water resources development at specific sites. The locations of sites at which data were collected are shown on plate A. Tables include records of 261 wells and logs of 8 wells and 456 test holes. Partial records of streamflow discharge measurements collected at gaging stations within the report area in the period 1965 to 1967 were augmented by stage measurements. (Knapp-USGS)
W70-10233

HYDROLOGIC CONDITIONS AND ARTIFICIAL RECHARGE THROUGH A WELL IN THE SALEM HEIGHTS AREA OF SALEM OREGON,
Geological Survey, Tacoma, Wash.
Bruce L. Foxworthy.
For sale by the Superintendent of Documents, U. Government Printing Office, Washington, D 20402. US Geological Survey Water-Supply Paper 1594-F, 1970. 56 p, 6 fig, 2 plate, 5 tab, 27 ref.

Descriptors: *Artificial recharge, *Injection wells, *Oregon, Water levels, Basalts, Aquifers, Water yield, Water quality, Permeability, Transmissivity, Suspended load.
Identifiers: Salem (Oregon).

In the Salem Heights area of Salem, Oreg., pumping from wells that tap a permeable zone of limited extent in basalt of the Columbia River Group caused serious year-to-year declines of groundwater levels. To determine the feasibility of reducing these declines by artificially augmenting the natural recharge and to develop techniques applicable to a municipal program of artificial recharge, 24.5 million gallons of surplus water was injected under pressure into one of the municipal wells during three periods, ranging in duration from 1 to 15 days, at an average injection rate of about 330 gallons per minute. The recharge water contained abundant dissolved air and, at times, excessive sediment; in other respects it was of excellent quality and was compatible with the native groundwater. The artificial recharge had no apparent deleterious effects on the quality of the groundwater. Pressure rise from the injected water spread rapidly through the permeable aquifer, but the residual buildup of groundwater levels was soon masked by a seasonal rising trend of levels. The geologic and hydrologic conditions, however, preclude the escape of substantial volumes of the recharge water. The conditions appear to be favorable for further artificial recharge. Changes in the specific capacity of the recharge well provide valuable guidance for subsurface injection operations. (Knapp-USGS)
W70-10236

WATER RESOURCES AT MARINE CORPS SUPPLY CENTER, BARSTOW, CALIFORNIA FOR THE 1969 FISCAL YEAR,
Geological Survey, Menlo Park, Calif.
J. H. Koehler.
US Geological Survey Open-file report, May 18, 1970. 22 p, 5 fig, 4 tab, 4 ref.

Descriptors: *Water supply, *Water resources development, *California, Aquifers, Water wells, Groundwater, Hydrogeology, Sampling, Data collections, Hydrologic data.
Identifiers: Barstow (Calif), Aquifer testing, Pumping tests.

The water supply for the Marine Corps Supply Center, Barstow, California is obtained from wells in the Barstow and Yermo groundwater subunits of the Mojave River basin. Recharge to the groundwater subunits depends almost entirely on seepage from floodflow in the Mojave River. In the 1969 water year the total flow at the gage at Barstow was 146,000 acre-feet which resulted in about 60,000 acre-feet of recharge to the groundwater subunits. Between March 1968 and April 1969 the water levels rose an average of 1.2 feet in the Yermo supply wells and 10.1 feet in the Nebo supply wells. The chemical quality of water from the Yermo supply wells is within the U.S. Public Health Service recommended limits for dissolved chemical constituents. Pumping tests were made of nine supply wells in the summer of 1969. The pumping test of well 9N/1E-3P2 (Yermo 5), drilled in July 1969, indicates that this well could be pumped at a sustained yield of at least 2,500 gpm. (Knapp-USGS)
W70-10237

GROUNDWATER GEOLOGY OF THE ROCK ISLAND, MONMOUTH, GALESBURG, AND KEWANEE AREA, ILLINOIS,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 02F.
W70-10284

4C. Effects on Water of Man's Non-Water Activities

WATER IN URBAN PLANNING, SALT CREEK BASIN, ILLINOIS--WATER MANAGEMENT AS RELATED TO ALTERNATIVE LAND-USE PRACTICES,
Geological Survey, Washington, D.C.
Andrew M. Spieker.

For sale by the Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 - Price $1.00. U S Geological Survey Water-Supply Paper 2002, 1970. 147 p, 52 fig, 5 tab, 33 ref.

Descriptors: *Water pollution, *Urbanization, *Illinois, Surface waters, Groundwater, Aquifers, Groundwater recharge, Streamflow, Drainage, Topography, Soils, Floods, Water quality, Water management (Applied), Water pollution control.
Identifiers: *Changing land use, Flood control measures.

This report concentrates on related urbanization problems of groundwater recharge, water quality, management of flood plains, and flood-control measures in the Salt Creek basin in Cook and Du Page Counties of the rapidly developing Chicago metropolitan area. Salt Creek basin has a drainage area of 150 square miles. It is in flat to gently rolling terrain, underlain by glacial drift as much as 200 feet thick which covers a dolomite aquifer. In 1964, the population of the basin was about 400,000, and 40% of the land was in urban development. The population is expected to number 550,000 to 650,000 by 1990, and most of the land will be taken by urban development. (Woodard-USGS)
W70-10070

JOHNSON V SOWELL (DAMAGE MEASURE WHERE SAND AND GRAVEL BASIN OVERFLOWS ONTO ADJOINING FARMLAND).
For primary bibliographic entry see Field 06E.
W70-10115

HAMRICK V CITY OF ALBERTVILLE (CITY'S LIABILITY FOR FLOODING CAUSED BY ROAD IMPROVEMENT).
For primary bibliographic entry see Field 06E.
W70-10217

EFFECTS OF CLEAR-CUTTING ON STREAM TEMPERATURE,
Oregon State Univ., Corvallis.
George W. Brown, and James T. Krygier.
Water Resources Research, Vol 6, No 4, p 1133-1139, August 1970. 7 p, 4 fig, 1 tab, 13 ref. FWPCA Grant WP-423.

Descriptors: *Water temperature, *Clear-cutting, *Thermal pollution, *Water pollution sources, *Lumbering, Forest management, Forestry, Solar radiation, Oregon, Vegetation effects.
Identifiers: Clear-cutting effects (Water temperature).

The amount of sunlight effective in warming streams may be increased after clear-cut logging. Average monthly maximum temperatures increased by 14 deg F and annual maximum temperatures increased from 57 deg to 85 deg F one year after clear-cut logging on a small watershed in Oregon's coast range. In a nearby watershed where strips of brush and trees separated logging units from the stream, no changes in temperature were observed that could be attributed to clearcutting. (Knapp-USGS)
W70-10248

STREAMFLOW CHANGES AFTER FOREST CLEARING IN NEW ENGLAND,
Forest Service (USDA), Durham, N. H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 03B.
W70-10249

CITY OF BIRMINGHAM V NICHOLS (ACCELERATED EROSION OF RAVINE EXCAVATED BY CITY).
For primary bibliographic entry see Field 02E.
W70-10288

ALEXANDER V CITY OF SHREVEPORT (EROSION OF PROPERTY BY WATER FLOWING FROM CITY CULVERT).
For primary bibliographic entry see Field 06E.
W70-10358

SOME PRINCIPLES OF FOREST HYDROLOGY PERTINENT TO EVEN-AGED MANAGEMENT OF EASTERN HARDWOODS,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
J. H. Patric.
Northern Logger and Timber Processer, July 1970, p 14-15, 26-27.

Descriptors: *Mountain forests, *Rainfall-runoff relationships, *Small watersheds, Accelerated erosion, Demonstration watersheds, Overland flow, Soil erosion, Soil stability, West Virginia.
Identifiers: *Clearcutting, *Logging roads, Forest watersheds, Logging, Turbidity, Experimental watersheds.

There is an historical basis for public and professional concern that the present swing to even-aged management of eastern hardwoods will have unwanted effects on forest water resources. Nevertheless, a review of the relevant literature shows that (1) clearcutting per se has negligible effect on hydrologic properties of forest soils, (2) clearcutting increases streamflow, and (3) logging roads cause most of the damage to streams draining clearcut forest land. (Patric-Forest Service)
W70-10421

4D. Watershed Protection

EROSION, RUNOFF, AND REVEGETATION OF DENUDED CONSTRUCTION SITES,
Agricultural Research Service, Lafayette, Ind. Soil and Water Conservation Research Div.; and Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
L. D. Meyer, W. H. Wischmeier, and W. H. Daniel.
Paper No 69-704, presented at American Society of Agricultural Engineers 1969 Winter Meeting, Chicago, Illinois, Dec 9-12, 1969. 8 p, 4 fig, 2 tab, 24 ref.

Descriptors: *Erosion, *Land forming, *Urbanization, *Sediment yield, *Sediment control, Road construction, Sedimentation rates, Slope stability, Soil conservation, Revegetation, Simulated rainfall, Erosion control, Land development.
Identifiers: Construction site erosion.

Erosion and runoff rates were measured for six treatments representing typical construction site conditions that result from major land reshaping. Subsequently, reestablishment of vegetation on these conditions was studied in relation to various methods of reshaping, mulching, fertilizing, and seeding. A series of simulated rainstorms totaling 5 inches was applied at an intensity of 2.5 in/hr on 35-foot subsoil plots with 12 percent slopes. The resulting erosion and runoff were very great. The only treatment that effectively controlled erosion was straw mulch, which reduced soil loss to less than 10 tons per acre. Of of the five original treatments on which revegetation was studied, applied topsoil was by far the most successful treatment. Mulched subplots were greatly superior to unmulched. A layer of good soil over a denuded area plus surface mulch is the best combination of those treatments tested for minimizing soil erosion and enhancing rapid revegetation on reshaped land. Additional benefits may be expected from minimized compaction of such areas, shallow surface tillage before seeding, use of a seed mixture containing fast-growing grasses, and application of supplemental irrigation as needed. (Knapp-USGS)
W70-10280

WATER RESOURCES PROBLEMS: PRESENT AND FUTURE REQUIREMENTS FOR LIFE,
For primary bibliographic entry see Field 06D.
W70-10312

LAND CAPABILITY: A HYDROLOGIC RESPONSE UNIT IN AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Beltsville, Md. Hydrograph Lab.
For primary bibliographic entry see Field 02E.
W70-10407

WATER REGULATION ON FOREST LAND.
Forest Service (USDA), Charleston. Southeastern Forest Experiment Station.
For primary bibliographic entry see Field 02I.
W70-10408

FOLKLORE AND BROMIDES IN WATERSHED MANAGEMENT.
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
Journal of Forestry Vol 67, No 6, p 366-371, June 1969.

Descriptors: *Watershed management, *Springs, *Snow management, *Erosion, Burning, Clear-cutting, Forest management, Distribution, Porosity, Interception.

Some common folklore and 'bromides' regarding the influence of forests and the effect of management practices on streamflow are examined in terms of fundamental concepts and research results. The topics discussed are: The interception paradox; organic layers--is twice as much twice as good. That ever-elusive field capacity; and logging, burning, grazing--good bad or indifferent.
W70-10410

A REVIEW OF 'HANDBOOK OF AFFORESTATION AND SOIL MELIORATION', A. V. AL'-BENSKII AND P. D. NIKITIN, EDITORS,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
James H. Patric.
Journal of Soil and Water Conservation, Vol 24, No 6, Nov-Dec 1969, p 238.

Descriptors: *Forestry, *Forests, *Shelterbelts, *Soil conservation, *Soil management, Drainage, Evapotranspiration, Land reclamation, Rainfall disposition, Snowmelt, Soil freezing.
Identifiers: Agro-silviculture.

Although Russian agrosilvicultural practices often resemble those used in this country, they developed under social and economic conditions so different from ours that the book provides little more than academic interest to most American conservationists. (Patric-Forest Service)
W70-10416

LOGGING ROADS AND WATER QUALITY,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
James H. Patric.
Proc Forest Engineering Workshop on Forest Roads, W. Va. University, 1970, p 11-16.

Descriptors: *Impaired water quality, *Soil contamination, Fertilizers, Gasoline, Oil wastes, Turbidity, Water pollution sources, Water temperature, West Virginia, Soil erosion.
Identifiers: *Forest roads, Logging roads.

Soil from eroding logging roads is the mot common and harmful pollutant of forest streams in West Virginia. Some consequences of pollution by soil and other contaminants from logging roads are reviewed. Forest managers can avoid most of this damage to water quality by applying known methods of water control on logging roads. (Patric-Forest Service)
W70-10417

EROSION CONTROL ON LOGGING ROADS IN THE APPALACHIANS,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
James N. Kochenderfer.
USDA Forest Serv Res Paper NE-158, NE, Forest Exp Sta, Upper Darby, Pa., 28 p, illus, 1970.

Descriptors: *Erosion, *Maintenance, *Roads, *Soil stabilization, Bank stabilization, Soil conservation, Soil erosion, Soil stability, Appalachian Mountain Region, West Virginia.
Identifiers: *Logging roads, Erosion control structures, Forest roads, Road location, Traffic control, Vegetation.

Practical methods of controlling erosion on logging roads are summarized through the different stages--planning, location, drainage, maintenance, and care after logging. The material was derived from existing literature, road lore, contact with experienced land managers, and personal experience. (Kochenderfer-Forest Service)
W70-10418

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

IDENTIFICATION OF OIL SPILLS: COMPARISON OF SEVERAL METHODS,
Melpar, Inc., Falls Church, Va.
J. Horowitz, G. D. Gumtz, R. G. Nemchin, and T. P. Meloy.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 283-296, 1970. 14 p, 88 ref.

Descriptors: *Tagging, *Tracking techniques, *Oily water, *Water pollution control, *Tracers, Analytical techniques, Water chemistry, Pollutant identification, Marking techniques, Legal aspects.
Identifiers: Oil spill treatment.

Several methods of identifying the source of oil pollution are critically examined. These methods are grouped into passive tagging and active tagging. Passive tagging assumes that oils are so chemically diverse that their contents constitute a stable chemical fingerprint that can be unequivocally disclosed in the laboratory. Active tagging requires that an inexpensive, coded material be added to oil; this material must be chemically and plysically stable in both oil and oil slicks; it must also be readily identifiable by available analytical techniques. Trace metals, sulfur-isotope ratios, paper chromatography, halogenated polycyclic aromatics, organometallics, and coded microspheroids were studied. Passive tags are not recommended because the passive tags are quite likely to mingle, to evaporate, to be dissolved, or to be oxidized. Even if these processes do not occur, they can create formidable forensic problems. Active tags are stable and identifiable. (See also W70-10035). (Knapp-USGS)
W70-10044

REMOTE SENSING OF OIL SLICKS,
Federal Water Pollution Control Administration, Washington, D.C. Div. of Water Quality Research.
L. G. Swaby, and A. F. Forziati.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 297-307, 1970. 11 p, 14 fig, 10 ref.

Descriptors: *Remote sensing, *Oily water, *Pollutant identification, Aerial photography, Water pollution control, Water pollution treatment, Satellites (Artificial), Aircraft, Infrared radiation.
Identifiers: Oil spills, Oil-slick sensing.

An overview of remote sensing methods i presented and illustrated with data taken at th Santa Barbara oil spill. Such methods possess moni toring capability but so far the ability to identify th slick material as oil has not been demonstrated The advantages and disadvantages of each metho are briefly discussed. (See also W70-10035). (K napp-USGS)
W70-10045

PESTICIDES IN SURFACE WATERS OF THI UNITED STATES--A 5-YEAR SUMMARY, 1964 68,
Federal Water Pollution Control Administration Cincinnati, Ohio. Analytical Quality Contro Branch.
James J. Lichtenberg, James W. Eichelberger, Ronald C. Dressman, and James E. Longbottom.
Pesticides Monitoring Journal, Vol 4, No 2, p 71 86, September 1970. 16 p, 2 fig, 8 tab, 9 ref.

Descriptors: *Pesticides, *Water quality, *Wate pollution sources, *Chlorinated hydrocarbon pesti cides, Surveys, Reviews, Data collections, Analyti cal techniques, Persistence.
Identifiers: Pesticides in water.

This report summarizes the results of five annua synoptic surveys (1964-68) for chlorinate hydrocarbon pesticides in surface waters of th United States. The results showed widespread oc currence of these compounds. The number of oc currences reached a peak in 1966 and the declined sharply in 1967 and 1968. Dieldrin an DDT and its congeners DDE and DDD were th compounds most frequently detected throughou the 5-year period. The maximum concentration found have not exceeded permissible limits as the relate to human intake directly from a domesti water supply. However, they have often exceede the environmental limit of 0.050 micrograms/lite recommended by the Federal Committee on Wate Quality Criteria. (Knapp-USGS)
W70-10050

NATURAL TRITIUM IN GROUNDWATER STU DIES,
Iceland Univ., Reykjavik.
For primary bibliographic entry see Field 02F.
W70-10093

TRITIUM HYDROLOGY IN NEW ZEALAND,
Department of Scientific and Industrial Research Lower Hutt (New Zealand). Div. of Nuclea Sciences.
For primary bibliographic entry see Field 02F.
W70-10094

OXYGEN-18 AND TRITIUM IN THE EVIA BASIN (FRENCH),
Geodynamics Investigation Center, Paris (France)
For primary bibliographic entry see Field 02K.
W70-10095

EVOLUTION OF TRITIUM ACTIVITY IN TH SOUTH-WEST OF FRANCE (FRENCH),
Institute of Geology of the Aquitaine Basin, Bo deaux (France). Faculty of Sciences.
For primary bibliographic entry see Field 02H.
W70-10096

TRITIUM AND HYDROGEOLOGY-IN VESTIGATIONS AND MEASUREMENTS CAR RIED OUT AT THE GRENOBLE NUCLEA RESEARCH CENTER (FRENCH),
Commissariat a l'Energie Atomique, Grenobl (France). Centre d'Etudes Nucleares.
For primary bibliographic entry see Field 07A.
W70-10097

SEASONAL VARIATIONS IN THE TRITIUM CONTENT OF GROUNDWATERS OF THE VIENNA BASIN, AUSTRIA,
International Atomic Energy Agency, Vienna (Austria).
For primary bibliographic entry see Field 02F.
W70-10098

ACTIVABLE RARE EARTH ELEMENTS ESTUARINE WATER TRACERS,
Stanford Univ., Calif. Dept. of Civil Engineering; and Public Health Service San Francisco, Calif.
J. K. Channell, and P. Kruger.
Fifth International Water Pollution Research Conference, San Francisco, July 26-Aug 1, 1970. Preprint, 20 p, 5 fig, 4 tab.

Descriptors: *Tracers, Estuary, Bottom sediments, Solubility, Chelation, Absorption, Sewage, Turbidity, Costs, Hydrogen ion concentration, Estuaries, Analytical techniques.
Identifiers: Nuclear Activation Analysis, San Francisco Bay, *Rare earth elements, *Europium, *Lanthanum.

A reliable analytical method has been developed for separating the rare-earth elements (REE) as a group from estuarine water and detecting europium and lanthanum in quantities as low as 1 ng and 20 ng per sample. Although REE may adsorp to suspended solids at normal pH, the analytical method measures these together with those in solution. Losses to bottom sediments can be estimated and are not serious for estuaries with average depths greater than 10 ft. These characteristics enable REE to be used in tracing the dissolved, suspended solids, and settleable solids phases of sewage effluent. Estuarine water can also be traced if REE are injected at a low pH in areas of low suspended solids concentration. The activable REE can also be used as multiple tracers or to extend the range of fluorescent dye or radionuclide tracers. The minimum detectable amount of added tracer is 110 ng/l for lanthanum and 15 ng/l for europium. Lanthanum tracer is less expensive than Rhodamine WT dye in large studies. Estimated lanthanum costs are slightly greater than tritium of La140 for large studies but may be preferable because of radiological health considerations. Europium is not economically competitive. (Upadhyaya-Vanderbilt)
W70-10210

THE QUALITY OF ARIZONA'S DOMESTIC, AGRICULTURAL, AND INDUSTRIAL WATERS,
Arizona Univ., Tucson. Agricultural Experiment Station.
G. R. Dutt, and T. W. McCreary.
Available from NTIS as PB-194 530, $3.00 in paper copy, $0.65 in microfiche. Arizona University Agricultural Experiment Station Report 256, February 1970. 83 p, 12 fig, 12 tab, 77 ref. OWRR Projects B-001-ARIZ (3), B-002-ARIZ (4), B-004-ARIZ (2).

Descriptors: *Water quality, *Arizona, Water chemistry, Surface waters, Groundwater, Sampling, Data collections, Hydrologic data, Trace elements, Water utilization.
Identifiers: Water quality data.

Waters of Arizona were sampled since 1966 to determine on a broad scope, not only the water quality with respect to the major ions but also the quality with respect to the minor or trace ions that may be either harmful or beneficial to the current and future uses. The concentration of the various solutes (dissolved substances) are compared to criteria to the effect of various solutes on the usefulness of water. (Knapp-USGS)
W70-10224

QUANTITY AND CHEMICAL QUALITY OF LOW FLOW IN THE PRAIRIE DOG TOWN FORK RED RIVER NEAR WAYSIDE, TEXAS, FEBRUARY 6-9, 1968,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02E.
W70-10229

RAPID MEASUREMENT OF ORGANIC POLLUTION BY TOTAL ORGANIC CARBON AND COMPARISONS WITH OTHER TECHNIQUES,
Geological Survey, Menlo Park, Calif.
J. W. Helms.
U S Geological Survey Open-file report, May 21, 1970. 9 p, 3 fig, 33 ref.

Descriptors: *Water analysis, *Organic matter, Biochemical oxygen demand, Oxygen demand, Organic wastes, Pollutant identification, Organic loading, Analytical techniques, Chemical analysis.
Identifiers: Total organic carbon analysis.

Among the techniques for measuring carbonaceous material in water, the TOC (total organic carbon) determination is probably one of the best in terms of speed and accuracy. As a means of monitoring waste discharge, the TOC method is the most applicable. Results can be obtained promptly to allow corrective measures to be made before significant impairment occurs in the receiving water. Waste discharging facilities can utilize on-site TOC monitors to shorten the time interval when improper treatment processes allow objectionable waste to be discharged. TOC monitors may also prove useful in the monitoring of various stages of waste treatment. Modifications of treatments could be initiated almost immediately to cope with changes in waste composition. Plant wastes for a particular process or product are generally uniform in content. If a correlation is established between methods, that correlation should hold until the process is changed. Where wastes contain a myriad of organic compounds, if one or a few should change in concentration, good correlation should still be possible since the total composition remains fairly uniform. Municipal or sanitary wastes fall into this category. (Knapp-USGS)
W70-10261

AN AUTOMATED METHOD FOR DETERMINING MERCURY IN WATER,
Department of Energy, Mines and Resources, Ottawa (Ontario). Inland Waters Branch.
P. D. Goulden, and B. K. Afghan.
Canada Department Energy, Mines and Resources, Inland Waters Branch Technical Bulletin No 27, 1970. 21 p, 13 fig, 3 tab, 5 ref.

Descriptors: *Pollutant identification, *Water analysis, *Heavy metals, *Spectrophotometry, *Flame photometry, Trace elements, Laboratory tests, Analytical techniques, Poisons, Sampling, Automation, Instrumentation, Measurement.
Identifiers: Mercury, Mercury analysis, Atomic absorption spectrophotometry.

A method is given for determining the mercury content in water with mercury concentrations as low as 0.05 micrograms/liter. The method was applied to water samples containing both inorganic- and organo-mercury compounds. It involves the oxidation of organo-mercury compounds by ultraviolet irradiation followed by the reduction of the mercury to the elemental state. The mercury is swept out of the solution by a stream of air and its concentration measured in an absorption cell in an atomic absorption spectrophotometer. For levels of mercury in the range 1.0 to 32 micrograms/liter the method is automated to measure 20 samples per hour. For levels of mercury in the range 0.05 to 1.0 micrograms/liter only 10 samples per hour can be processed because a longer sampling time is required. (Knapp-USGS)
W70-10263

BIOLOGICAL SYSTEMS AS POLLUTION MONITORS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Biology.
John Cairns, Jr., Richard E. Sparks, and William T. Waller.
Research/Development, Vol 21, No 9, p 22-24, Sept 1970. 3 p, 6 fig.

Descriptors: *Monitoring, *Water pollution control, *Water pollution effects, *Bioindicators, Fish, Water chemistry, Toxicity, Trace elements, Poisons, Waste disposal.
Identifiers: Water pollution monitoring.

The use of continuous monitoring of the activity of aquatic life in a stream to detect an increase in the level of pollutants before the increase reaches the danger levels was studied using fish in tanks. Three biological parameters of fish--movement, breathing and electrocardial activity--are monitored with two types of apparatus. Basically, each apparatus consists of test chambers in which fish are maintained, sensing devices, amplifiers and records. The swimming movement monitor uses photoresistors as sensors. One fish is maintained in each of six, 5-gallon aquaria. Each aquarium is traversed by light beams at the top, middle and bottom levels. When a fish moves through a light beam at a particular level, a photoresistor acts through an amplifier to make a blip on an event recorder and to advance a digital counter. The breathing and electrocardial monitor uses a needle electrode inserted in the breast of the fish as a sensor. By using biological monitoring systems, it is possible to obtain quick information as to when a waste toxicant level changes. The type of information generated is of such a nature that it can be fed directly into a computer, and the time lag in determining changes can be significantly reduced. (Knapp-USGS)
W70-10273

SPECTRAL ANALYSIS--APPLICATIONS IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Washington, D.C. Estuarine and Oceanographic Programs Branch.
T. A. Wastler.
Federal Water Pollution Control Administration Report CWT, December 1969. 99 p, 34 fig, 13 tab, 17 ref.

Descriptors: *Statistical methods, *Frequency analysis, *Fourier analysis, *Time series analysis, *Water quality, Estuaries, Digital computers, Water pollution control, Analytical techniques, Data processing, Path of pollutants.
Identifiers: Spectral analysis.

The application of spectral analysis is explained for the interpretation of time series water quality data, both in estuaries and in free-flowing streams. The statistical manipulation of time-series data by spectral analysis results in the computation of those parts of the variance of a record that recur at constant time intervals as well as the part that is random (non-recurring) in character. The power spectrum computation is the fundamental operation of data reduction and interpretation by means of spectral analysis; the many other computations that can be made in spectral analysis are all based firmly upon the concept and calculation of individual power spectra. Like any other method of data analysis, this method has its limitations and disadvantages. Three major requirements for the record may be regarded as limiting. First, the record must be fairly long--generally having over 100 sequential measurements. Second, there must be no missing data--if measurements are missing, suitable values must be interpolated before spectral analysis is attempted. Third, the mathematical procedures require so much computation that the use of a high-speed digital computer is essential for most analyses. (Knapp-USGS)
W70-10279

ELECTROPHORETIC CLARIFICATION OF WATER,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 05D.
W70-10314

FISH BIOASSAYS - REPRODUCIBILITY AND RATING,
Virginia Polytechnic Inst., Blacksburg. Dept. of Biology.

John Cairns, Jr.
Separata de Rivista de Biologia, Vol 7, Nos 1-2, p 7-12, 1969. 8 ref, 2 tab, 9 fig.

Descriptors: *Bioassay, *Methodology, *Test procedures, Laboratory tests, Testing, Variability, Laboratory animals, Acclimatization, Fish behavior.
Identifiers: *Reproducibility, *Rating system, Synthetic water, Test organisms, Fish bioassays.

This paper proposed that research bioassay investigations be carried out with methods and procedures that can be duplicated in other laboratories. Also suggested was a rating system to indicate how closely an author has adhered to generally accepted bioassay methodology. The two major obstacles to obtaining data that may be readily reproduced are lack of certainty regarding (1) the quality of the dilution water and (2) the uniformity of the response of the test organism. The use of synthetic dilution waters will overcome the first problem and using an accepted test species (list given) will overcome the second problem. (Sjolseth-Washington)
W70-10326

ASSAYING ALGAL GROWTH WITH RESPECT TO NITRATE CONCENTRATION BY A CONTINUOUS FLOW TURBIDOSTAT,
California Univ., Berkeley; and Ministry of Health, Jerusalem (Israel).
G. Shelef, W. J. Oswald, and C. C. Golueke.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint. 9 p.

Descriptors: *Analytical techniques, *Algae, *Assay, Chlorella, Nitrates, Chemical analysis, Chlorophyta, Diatoms, Temperature, Optical properties, Growth rates.
Identifiers: *San Joaquin Delta (Calif), *Continuous flow turbidostat, *Growth kinetics, Chemostats, Flagellate algae, Optical density sensor.

This study employed a continuous flow turbidostat and a chemostat to appraise the effect of nitrate-nitrogen concentration on the growth of two strains of Chlorella pyrenoidosa (TX 71105 and Emerson). In one trial a mixture of algae indigenous to San Joaquin Delta (California)--green, green flagellates and diatoms--was used as test organisms. The specific growth rate increased with temperature and concentration of nitrogen. The concentration of nitrate-nitrogen decreased with temperature above 35C. The growth optimum was not necessarily optimum for nitrate utilization. The mixed culture of algae showed substantial specific growth rate at much lower nitrogen concentration than C pyrenoidosa. Results of the study emphasize the wide difference in nitrogen requirements of various algal species. The turbidostatic method proved more expensive, but more advantageous than the chemostatic method. (Wilde-Wisconsin)
W70-10403

5B. Sources of Pollution

JOINT CONFERENCE ON PREVENTION AND CONTROL OF OIL SPILLS.
American Petroleum Inst., New York; and Federal Water Pollution Control Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-10035

A HISTORY OF MAJOR OIL SPILL INCIDENTS,
Federal Water Pollution Control Administration, Washington, D.C. Div. of Technical Support.
K. E. Biglane.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 5-6, 1970. 2 p.

Descriptors: *Water pollution sources, *Water pollution control, *Water pollution treatment, *Oily water, Oil industry, Ships, Oil wells, Oil-water interfaces, Oil wastes.
Identifiers: Oil spills, Shipwrecks.

The major oil spills of recent years are summarized and some of the causes of these spills and their effects on the environment are discussed. Research needed to control oil spills and domestic and international legislation needed to provide compensation for oil pollution damage are recommended. (See also W70-10035). (Knapp-USGS)
W70-10036

UNITED KINGDOM MINISTRY OF TECHNOLOGY WORK ON OIL POLLUTION,
Warren Spring Lab., Stevenage (England).
For primary bibliographic entry see Field 05G.
W70-10037

MICROBIAL MODIFICATION OF CRUDE OIL IN THE SEA,
Scripps Institution of Oceanography, La Jolla, Calif.
C. E. ZoBell.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 317-326, 1970. 10 p, 84 ref.

Descriptors: *Oily water, *Biodegradation, *Oil, Nutrients, Bacteria, Oxidation, Path of pollutants, Aquatic microbiology.
Identifiers: Oil spills, Oil decomposition.

Hydrocarbons and crude oils are susceptible to microbial oxidation. More than a hundred species of bacteria, yeasts, and fungi are able to oxidize hydrocarbons. Each species is limited in the kinds of hydrocarbons it can attack and also by the temperature, salinity, surface tension, pH, oxygen tension, and other environmental conditions. Oil-oxidizing bacteria are most abundant in coastal waters and mud where oil pollution is chronic. Such bacteria are extremely scarce in the open sea. Bacteria in well-oxygenated waters might oxidize oil at rates ranging from 0.02 to 2 grams per square meter per day at 20 deg to 30 deg C. (See also W70-10035). (Knapp-USGS)
W70-10046

MICROBIAL DEGRADATION OF NORMAL PARAFFIN HYDROCARBONS IN CRUDE OIL,
Florida State Univ., Tallahassee. Dept. of Oceanography.
R. J. Miget, C. H. Oppenheimer, H. I. Kator, and P. A. LaRock.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 327-331, 1970. 5 p, 9 fig, 2 tab, 7 ref.

Descriptors: *Biodegradation, *Oil, *Oily water, Oxidation, Nutrients, Surfactants, Bacteria, Microorganisms, Path of pollutants, Aquatic microbiology.
Identifiers: Oil spills, Oil decomposition.

Experiments were designed to measure the oxidation and degradation of crude oils by naturally occurring marine microorganisms. Fifty active oil degrading cultures were isolated in enriched seawater containing crude oil. Oil degradation was determined with gas chromatography, wet combustion, and by measurement of surface tension. Normal paraffin hydrocarbons through C-26 are degraded by two different groups of microorganisms--those growing in the oil phase only and those growing in the aqueous phase. Emulsification of the crude oil through production of surfactants was observed in many of the enriched cultures. Microbial degradation of 35 to 55% of oxidizable crude oil occurred within 60 hours. (See also W70-10035) (Knapp-USGS)
W70-10047

KINETICS OF DISSIPATION ANI BIODEGRADATION OF CRUDE OIL I ALASKA'S COOK INLET,
Alaska Univ., College. Inst. of Marine Science.
P. J. Kinney, D. K. Button, and D. M. Schell.
Financial support provided by the Western Oil an Gas Association. Proceedings of Joint Conferenc on Prevention and Control of Oil Spills, Americar Petroleum Inst, and Federal Water Pollution Con trol Admin, Dec 15-17, 1969, New York, NY published by American Petroleum Inst, New York p 333-340, 1970. 8 p, 5 fig, 21 ref.

Descriptors: *Biodegradation, *Oil, *Oily water *Alaska, Oxidation, Nutrients, Bacteria, Aquati microorganisms, Aquatic microbiology, Path o pollutants.
Identifiers: Cook Inlet (Alaska), Oil spills, Oi decomposition.

The magnitude of oil pollution problems i Alaska's Cook Inlet was studied. Physical dissipa tion and biodegradation rates were determined an combined with estimates of hydrocarbon inpu rates to assess the fate of oil. Hydrocarbon accumu lation is less than the present limits of detection Cook Inlet flushing is 90% complete in 10 months Unsupplemented Cook Inlet water effectivel degrades Cook Inlet crude, this biodegradation i essentially complete in the order of a few months and the biodegradation capacity of Cook Inlet i large. Thus biodegradation is more important tha physical flushing in removing hydrocarbon pollu tants from Cook Inlet. The methods and results ar discussed in terms of their applicability to othe areas. (See also W70-10035). (Knapp-USGS)
W70-10048

PESTICIDES IN SURFACE WATERS OF THI UNITED STATES--A 5-YEAR SUMMARY, 1964 68,
Federal Water Pollution Control Administration Cincinnati, Ohio. Analytical Quality Contro Branch.
For primary bibliographic entry see Field 05A.
W70-10050

DISPERSAL OF EFFLUENTS IN THE GREA LAKES,
Waterloo Univ. (Ontario).
G. T. Csanady.
Water Research, Vol 4, No 1, p 79-114, Januar 1970. 36 p, 34 fig, 32 ref. FWQA Grant No WP 01139-01.

Descriptors: *Dispersion, *Path of pollutants *Great Lakes, *Currents (Water), Outlets, Waste disposal, Water pollution sources, Water pollutio control, Mixing, Jets, Turbulence, Water circula tion, Thermal stratification, Lakes, Limnology Tracers, Tracking techniques, Diffusion, Mode studies, Hydraulic models, Mathematical models.
Identifiers: Conservative pollutants.

A comprehensive description is given of the physi cal factors involved in the dispersal of conservativ pollutants in the Great Lakes, based mainly on ex perimental data obtained in Lakes Huron and Eri over 7 years. Parameters important in small-scal diffusion problems are current speed and effectiv (eddy) diffusivity. Constant values of thes parameters adequately describe the diffusion of in dividual parcels or plumes of marked fluid, but th appropriate values depend on turbulence intensity which is in turn dependent on thermal stratifica tion. On a larger scale, the meandering of effluen plumes becomes an important dispersa mechanism. With some meandering, however, ef fluents discharged near shore almost alway generally follow the shorelines, apparently i response to the lake-wide flow pattern which is be lieved to be characterized by coastal jets nea

shores and (at least during the summer periods) oscillating currents in the central portions. The resulting phenomenon of coastal entrapment of pollutants leads, for a near-shore source, to the formation of a relatively heavily polluted influence region of typically perhaps 25 km extent either side of the source. (Knapp-USGS)
W70-10051

FLOW FROM A SPHERICAL SOURCE WITH WATER CONTENT DEPENDENT DIFFUSIVITY,
San Jose State Coll., Calif.
Rameshwar Singh.
Water Resources Research, Vol 6, No 4, p 1140-1147, August 1970. 8 p, 3 fig, 1 tab, 8 ref.

Descriptors: *Water pollution sources, *Path of pollutants, *Diffusion, *Soil water movement, *Radioactive wastes, Equations, Groundwater movement, Leaching, Mathematical models, Mixing, Radioactive waste disposal, Unsaturated flow, Saturated flow, Adsorption, Adsorption, Ion transport.
Identifiers: Spherical diffusivity.

Leakage of moisture from underground buried sources can occur because of cracking or deterioration of containers. Leaking moisture can be radioactive or contaminated and may endanger public health. In disposal of such substances underground, consideration must be given to the extent of dispersal of moisture from wet containers in case of accidents. The movement of moisture from a spherical buried source into partially saturated surroundings is described by a nonlinear partial differential equation. Complexity of the equation prevents obtaining an explicit solution of the problem; however, an approximate solution may be extracted by the method of weighted residuals. The technique calls for representing the solution with a polynomial in space variable that has its coefficients as unknown functions of time, to be determined from the conditions and by satisfying the equation by averaging over the range of space-variable. This procedure accepts any kind of diffusivity function including numerical values obtained from experiments. The method is simple in its application and produces results that compare well with the known solution. (Knapp-USGS)
W70-10058

THE RELATIONSHIP BETWEEN DISSOLVED NUTRIENT SALTS AND PROTEIN PRODUCTION IN SUBMERGED AUTUMNAL LEAVES,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 02K.
W70-10163

AGRICULTURE CHEMICALS AND OUR WATER RESOURCES,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
Edwin J. Monke, and Philip R. Goodrich.
Agricultural Engineering, Volume 51, No. 6, p. 358, June 1970.

Descriptors: *Agricultural chemicals, *Nitrates, *Pesticide residues, Activated carbon, Storm runoff.
Identifiers: *Bio-environmental control, Methemoglobinemia, Cynanosis.

Although bio-environmental control has been suggested as an alternative to pesticide usage, agrochemical usage can be made safe to the environment by good management. Pesticides are being blamed for contamination of water on a large scale, but pesticide pollution occurs mainly from land runoff or from polluting manufacturing processes. Agricultural engineers are also faced with the problem of developing methods to alleviate pollution caused by nitrate fertilizers. The long held idea that deep wells could satisfactorily counter the ill effects from nitrate leaching has proven to be unacceptable. (Holmes-Rutgers)
W70-10185

OXYGEN DYNAMICS IN THE THERMAL MIXING ZONE,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Chemical Engineering.
R. C. Ahlert, and D. Nochumson.
Fifth International Water Pollution Research Conference, San Francisco, July 26-Aug 1, 1970. Preprint, 14 p, 10 fig, 1 tab, 25 ref.

Descriptors: *Thermal pollution, *Mixing, Dispersion, Reaeration, Mathematical models, Diffusion, Velocity.
Identifiers: Equilibrium index, Oxygen dynamics, Reaction rate constant.

A conventional, one-dimensional model of oxygen dynamics is not satisfactory for that stretch of a river downstream of a thermal outfall, which can be characterized as the mixing zone. The oxygen dynamics of the mixing zone have been analyzed on the basis of interfacial reaeration and carbonaceous biological oxygen demand. Great care must be taken in sampling thermal and material quality of stream in regions that involve interaction between thermal and material outfalls. Regions of stratification and channeling can be expected downstream of some outfalls. The combination of thermal dispersion processes, both chemical and biological reactions and transport processes at the interface can yield results totally unpredicted by one dimensional modelling. Of particular importance is the capacity of this technique to predict the point at which limited sampling downstream of one or more outfalls becomes a possible basis for stream quality management involving both physical and/or legal control. (Upadhyaya-Vanderbilt)
W70-10208

ACTIVABLE RARE EARTH ELEMENTS ESTUARINE WATER TRACERS,
Stanford Univ., Calif. Dept. of Civil Engineering; and Public Health Service San Francisco, Calif.
For primary bibliographic entry see Field 05A.
W70-10210

PLUME LENGTHS PREDICTED MATHEMATICALLY.

Electrical World, May 4, 1970. 39 p, 1 fig, 1 tab.

Descriptors: *Cooling towers, Thermal pollution, Dispersion, Computer programs.
Identifiers: *Plume lengths.

Kaylor and associates used a mathematical model developed for stack dispersion studies and adapted it for cooling-tower use. A Stone and Webster computer program called CLOUD was developed to use psychrometric charts, and the Pasquill-Turner stability classes. The program input requires a water-vapor emission rate from a cooling tower, tower height and diameter, wind speed, stability classes, downwind distances and relative humidities with corresponding ambient dry-bulb temperatures. The output includes the values of the visible plume lengths at the specified conditions. The predicted plume lengths were, on the average, 21% higher than the observed values. Neglect of plume rise is probably the cause of the somewhat higher predicted values. (Upadhyaya-Vanderbilt)
W70-10220

CONDITIONS OF RECIRCULATION OCCURRENCE AT COOLING WATER INTAKE (In Polish),
Adam Widomski.
Gospodarka Wodna, 1970, No 1, p 3-7. 11 fig, 5 ref.

Descriptors: *Cooling, Streams, *Thermal powerplants, *Heat balance, Thermal stratification, *Thermal pollution, Temperature, Water temperature, Thermal conductivity.

Experimental investigations concerning some river sectors in the vicinity of warm water outflow in power plants have been carried out in models under the conditions of plant operation. Current directions and the occurrence of recirculation have been perceived. The recirculation is dependent on the Froude number, the quantity of water taken up from rivers and the distance between the points of the water outlet and the water intake. The results of the investigations enable estimations of the limit conditions of the occurrence of recirculation and its consequences for cooling water intake from streams. Significant stratification in streams has been observed. For regular river channels the occurrence of the recirculation can be described by the following: Froude number, the intake-outlet nondimensional ratio delta L/B where B is width of stream, and nondimensional flow ratio Qu/Qo where Qu is the cooling water intake rate and Qo is the original flow in the river. (Novotny-Vanderbilt)
W70-10222

ANALYSIS TECHNIQUES FOR HOUSTON SHIP CHANNEL,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
Roy W. Hann, Jr.
ASCE Proceedings, Journal of the Waterways and Harbors Division, Vol 96, No WW 2, Paper 7258, p 171-180, May 1970. 10 p, 9 fig, 1 ref.

Descriptors: *Path of pollutants, Estuaries, *Bays, *Currents (Water), *Tides, Water pollution sources, Saline water intrusion, Stratified flow, Stratification, Water quality, Hydraulic models, Computer models, Dispersion, Surveys, Sampling.
Identifiers: Houston Ship Channel (Texas).

The environmental pollution problems of the Houston Ship Channel are defined and the broad program to provide analytical management tools is presented. Methodology is presented for the evaluation of the tidal mass water movement and for the evaluation of the density current couple which is superimposed on the tidal mass movement. Degree of Stratification is defined and its value discussed. The basic philosophy of the steady model with provisions for stratified analysis presented and preliminary results are displayed. The field program being carried out by Texas A and M University to provide data for the verification of the presented methods and for more elaborate methods yet to be developed is outlined. (Knapp-USGS)
W70-10266

USE OF ISOTOPIC DECAY RATES IN TURBULENT DISPERSION STUDIES,
Weizmann Inst. of Science, Rehovoth (Israel).
M. Beran, and G. Assaf.
Journal of Geophysical Research, Vol 75, No 27, p 5279-5285, September 20, 1970. 7 p, 3 fig, 16 ref.

Descriptors: *Radioactivity techniques, *Diffusion, *Dispersion, *Turbulent flow, Mixing, Tracers, Path of pollutants, Analytical techniques, Radioisotopes, Radioactive dating, Radioactivity.
Identifiers: Isotopic decay rates.

The differences in isotopic decay rates can be used to determine information about time-dependent turbulent dispersion from steady-state measurements. Mean horizontal transport results from vertical turbulent dispersion coupled with a mean horizontal wind that has a vertical gradient. Applications to atmospheric and oceanographic conditions are discussed. If it is possible to measure the steady-state vertical concentration gradient resulting from an infinite plane source, the time-dependent vertical concentration distribution resulting from an instantaneous point source can be calculated. This information can then be used to determine the mean horizontal transport. Atmospheric dispersion of natural isotopes emanated from the ground is discussed in the context of this solution. (Knapp-USGS)
W70-10268

TRITIUM IN CRATER LAKE, OREGON,
Lamont-Doherty Geological Observatory, Palisades, N.Y.
H. James Simpson.
Journal of Geophysical Research, Vol 75, No 27, p 5195-5207, September 20, 1970. 13 p, 5 fig, 9 tab, 20 ref. AEC Grant AT (30-1) 2493.

Descriptors: *Tritium, *Fallout, *Lakes, *Craters, Hydrologic budget, Water balance, Seepage, Evaporation, Hydrogeology, Mixing, Precipitation (Atmospheric), Sampling.
Identifiers: Crater Lake (Oregon).

Input by precipitation can explain most of the tritium content of Crater Lake, Oregon. The hydrology of Crater Lake makes it ideal for this study because less than 1/2 of 1% of the lake volume is lost from the lake by vapor exchange because the surface concentration is diluted by vertical mixing. If Crater Lake has retained nearly all its input tritium, and if less than half of this input was supplied by vapor exchange as derived from budget calculations, deep lakes with small drainage basins can provide good estimates of the total tritium rainout. (Knapp-USGS)
W70-10269

A REVIEW OF CHLORINATED BIPHENYL CONTAMINATION IN NATURAL WATERS,
Wisconsin Univ., Madison, Water Chemistry Lab.
Gilman D. Veith, and G. Fred Lee.
Water Research, Vol 4, No 4, p 265-269, April 1970. 5 p, 28 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Organic compounds, *Pollutant identification, *Reviews, *Water pollution sources, Chromatography, Gas chromatography.
Identifiers: Chlorinated biphenyls.

A review of the present state of knowledge concerning environmental contamination by organochlorine compounds indicates that the chlorinated biphenyls may be one of the more widespread contaminants. The significance of this contamination has not yet been evaluated due, in part, to the lack of systematic analytical procedures for the quantitative and qualitative determinations of the components of chlorinated biphenyl mixtures. The possibility of the chlorinated biphenyls producing serious errors in chlorinated pesticide analyses is emphasized. (Knapp-USGS)
W70-10277

AN ECONOMIC MODEL FOR A POLLUTED RIVER SYSTEM,
V. K. Collinge, D. H. Newsome, A. L. Downing, and J. Renold.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-6. 7 p.

Descriptors: *Mathematical models, *Dissolved oxygen, *Biochemical oxygen demand, *Water quality, *Pollution abatement, Water pollution control, Chlorides, Economic benefits, Ammonia.

The river Trent in England is undergoing an extensive systems analysis, in order to derive technical and economic solutions to its severe pollution problems. The river's tributary, the Tame, drains the Birmingham industrial area with a population of 2.1 million. The Trent River authority needs to develop additional water supplies from the river. The economic modelling requires quantitative relationships between cost, quality, quantity, use and benefit. A key concept is 'quality state', meaning an ordered set of concentrations of water quality constituents. (This appears similar to term 'objective sets' used by Delaware River Basin Commission). Substances such as chlorides and suspended solids are found to act conservatively but BOD, dissolved oxygen and ammonia were analyzed using the Streeter-Phelps relationships. Dynamic programming has been chosen for the mathematical modelling, considering the river to consist of a number of reaches or stages. Methods of evaluating benefits of various quality states are being worked out. (Whipple-Rutgers)
W70-10370

WATER QUALITY AND MANAGEMENT EXPERIENCES OF THE DELAWARE RIVER BASIN COMMISSION,
Delaware River Basin Commission, Trenton, N.J.
J. F. Wright, and R. Porges.
Fifth International Water Pollution Research Conference, San Fracisco, July 26-August 1, 1970. Preprint, Paper I-3. 17 p.

Descriptors: *Mathematical models, *Dissolved oxygen, *Biochemical oxygen demand, *Water quality, *Pollution abatement, Water pollution control.
Identifiers: Objective sets, Water quality enforcement zones, BOD allocation.

Although technical aspects of water quality control are within our grasp, and general public support is available, there remain knotty public policy problems to be solved. Experiences of the Delaware River Commission should aid in solving these problems. The mathematical modelling of the biochemical oxygen demand regimen of the Delaware estuary represents the primary pollution problem of the basin. This modelling, originally accomplished by a steady-state assumption has now been elaborated into a time varying model more representative of tidal flows. With the use of this model, costs may be obtained of various alternative sets of standards, called objective sets. In terms of detailed implementation, the ideal least cost solutions proved impracticable; standards are therefore set by zones, and each facility is given an allocation in terms of primary BOD. As implementation of these controls continues, principles and procedures are being developed which should be applicable in other basins. (Whipple-Rutgers)
W70-10371

NITRIFICATION IN TREATMENT PLANTS AND NAUTRAL WATERS: SOME IMPLICATIONS OF THE THEORETICAL MODELS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 05D.
W70-10388

LOGGING ROADS AND WATER QUALITY,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-10417

WATER POLLUTION AND THE TEXTILE INDUSTRY,
For primary bibliographic entry see Field 05D.
W70-10427

REAMS V CITY OF LONDON (SUIT FOR DAMAGES TO PROPERTY CAUSED BY POLLUTION OF A STREAM).
For primary bibliographic entry see Field 06E.
W70-10439

STONE V CITY OF ASHLAND (CITY'S LIABILITY FOR WATER POLLUTION FROM MUNICIPAL SEWERS).
For primary bibliographic entry see Field 06E.
W70-10440

THE PANAM (LIBEL FOR THE DISCHARGE OF OIL INTO COASTAL NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W70-10442

SHUSTER V CITY OF CHISHOLM (LIABILITY FOR POLLUTION OF STREAM).
For primary bibliographic entry see Field 06E.
W70-10444

DOLLAR SS CO V UNITED STATES (DISCHARGE OF REFUSE INTO NAVIGABLE WATERS).

101 F2d 638-640 (9th Cir 1939).

Descriptors: *Hawaii, *Water pollution, *Ships, *Waste disposal, Legislation, Pollutants, Water pollution control, Water pollution sources, Judicial decisions, Legal aspects, Navigable waters, Admiralty, Harbors, Flotsam, Federal government, United States, Regulation.

Plaintiff United States brought libel against defendant vessel under a federal statute which prohibits the discharge of refuse into navigable waters of the United States. Defendant threw garbage into Honolulu harbor by its agent; however, defendant had attempted to prevent the discharge, and proved at trial that the discharge was unintentional and not for want of due care. Defendant contended that the unintentional discharge did not violate the statutory prohibition. The court ruled that the wording of the statute did not require intent or lack of due care for liability, being simply a prohibition of refuse discharge with an accompanying sanction. Interpreting the statute as holding any vessel strictly liable for refuse discharge, the court affirmed the decision of the lower court for plaintiff. (Hart-Florida)
W70-10462

5C. Effects of Pollution

BLUE-GREEN ALGAL BLOOMS IN SASKATCHEWAN LAKES,
Saskatchewan Univ., Saskatoon.
For primary bibliographic entry see Field 02H.
W70-10165

THE EFFECT OF SOME ECOLOGICAL FACTORS ON BACTERIA IN WATER,
Institute of Experimental Hygiene, Bratislava (Czechoslovakia). Dept. of Water Hygiene.
Imrich Daubner.
Verhandlungen Internationale Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 731-743, 1969. 10 fig, 10 ref.

Descriptors: *Water pollution effects, *Ecology, *Bacteria, *Water, Enteric bacteria, Sampling, Clostridium, Actinomycetes, Plankton, Temperature, Flow rates, Water pollution, Water quality, Turbulence, Sedimentation, Viruses, Bacteriophage, Trophic level, Indicators, Microbiology, Microscopy, Laboratory tests.
Identifiers: *Enterobacteriaceae, Danube River, Enterococci, Ammonizing bacteria, Leptospirae, Microbial plankton, Anaerobic sporulating clostridia, Beet-sugar, Austria, Moravia, Fecal pollution.

A study of regularities in number of microbes in water in the course of the year under the influence of physical, chemical, and biological factors in natural biotope and also of some chosen phenomena in laboratory experiments is described. Factors influencing survival of bacteria of the family Enterobacteriaceae in water in a positive and negative sense are evaluated with the objective to utilize natural elements of the water medium--bacterial antagonism--resulting in prompt elimination of bacteria from water. For indicators of fecal contamination of water (using membrane filters) the number of colonies of Enterobacteriaceae, enterococci, and anaerobic sporulating clostridia are determined. A major ecological factor influencing bacteria numbers in water is flow-rate per second. In biotope investigated, total count of microbes is in inverse proportion to water flow-rate. A reverse

correlation to flow-rate is shown also by heterotrophic bacteria cultivated at 20C and 37C, as well as the determined indicators of fecal contamination, Enterobacteriacea, enterococci, and anaerobic sporulating clostridia. While in the case of Enterobacteriaceae a positive correlation exists, relationships between the number of enterococci and clostridia to the temperature is reversely proportional. (Jones-Wisconsin)
W70-10169

THE GENERAL ANALYSIS OF A EUTROPHIC SYSTEM,
Alberta Univ., Edmonton. Dept. of Zoology.
For primary bibliographic entry see Field 02H.
W70-10170

SOME EFFECTS OF ORGANIC WASTES ON AQUATIC INSECTS IN IMPOUNDED HABITATS,
Louisiana State Univ., Baton Rouge. Dept. of Entomology., and Louisiana State Univ., Baton Rouge. Dept. of Microbiology.
C. D. Steelman, and A. R. Colmer.
Annals of the Entomological Society of America, Vol 63, No 2, p 397-400, 1970. 3 tab, 4 ref.

Descriptors: *Water pollution effects, *Organic wastes, *Aquatic insects, Habitats, Impounded waters, Coliforms, Mosquitoes, Lagoons, Indicators, Livestock, Water pollution sources.
Identifiers: Swine, Lagoon studies, Culex pipiens quinquefasciatus, Escherichia coli, Escherichia freundii, Escherichia intermedia, Aerobacter aerogenes, Coptotomus, Hydrous triangularis, Chironomus plumosus, Chaoborus, Brachydeutera, Musca domestica, Psychoda, Hermetia illucens, Stratiomys, Eristalis aeneus, Tabanus, Odonata.

The relative effects of organic waste pollution on the aquatic insect fauna of a freshly dug livestock waste disposal lagoon was studied. Introduction of organic waste material from swine pens into impounded aquatic habitat caused suppression of certain insect species. Decreases in aquatic insect fauna paralleled the increase in the organic waste concentration determined by changes in the numbers of coliform bacteria. The southern house mosquito, Culex pipiens quinquefasciatus Say, began laying eggs in the lagoon when coliform counts approximated 7000 organisms per milliliter of lagoon water. Water suspensions of pure cultures of coliforms Escherichia coli, E freundii, and E intermedia were found to be more attractive as oviposition sites for C p quinquefasciatus than water suspensions of Aerobacter aerogenes or sterile water. The change in insect fauna in the new lagoon during the 2-1/2 years' study was considered to be directly related to the change in the organic waste pollution of the water. The data obtained indicate the possibility of using aquatic insects as biological indicators of water quality. (Jones-Wisconsin)
W70-10171

MANAGEMENT OF AQUATIC VASCULAR PLANTS AND ALGAE,
Cornell Univ., Ithaca, N.Y. Dept. of Botany.
For primary bibliographic entry see Field 02I.
W70-10175

EUTROPHICATION SPEEDED BY MAN,
Richard H. Gilluly.
Science News, Vol 98, No 1, p 17-19, July 4, 1970. 4 fig.

Descriptors: *Eutrophication, *Phosphorus, *Nitrogen, Sewage disposal, *Detergents.
Identifiers: *Lake Washington, Lake Tahoe, Lake Erie, Lake Monona, Lake Sebasticook, Secchi Disk.

Disposal of intolerable amounts of phosphorus and nitrogen are speeding up the eutrophication process of lakes in North America and throughout the world. These nutrients stimulate plant growth and turn the lake into a marshy foul-smelling, fish killing, oxygen lacking body of water. A great deal of this accelerated eutrophication is the direct result of sewage disposal into the lakes. Detergent phosphates and nitrates are also potent accelerating forces. Although the causes have been identified, the cure is often very difficult to administer because of political and economic obstacles. The 'most obvious' solution is to divert sewage to another outlet or to subject it to tertiary treatment. (Holmes-Rutgers)
W70-10181

COOLING-TOWER EFFECTS: STUDIES ABOUND,
IIT Research Inst., Chicago, Ill.
E. Aynsley.
Electrical World, May 11, 1970, p 42-43. 3 fig.

Descriptors: *Cooling towers, Humidity, Precipitation (Atmospheric), *Environmental effects.
Identifiers: Keystone generating station, Stack gases, *Climatic conditions.

There is some apprehension today that cooling-tower emissions may produce undesirable environmental effects. Inadvertent weather effects, including local fogging and icing, cloud formation, and increased precipitation are often cited as possibilities. Initial results from ground and aerial studies being conducted by IIT Research Institute of Chicago at 1800-Mw, Keystone Generating Station indicate that no immediate problems appear to exist. There were 16 towers operational at the end of 1969 in U.S. Current projections indicate 33 towers within the next two years. Measurements of cooling-tower plume profiles indicate that humidity increases can be detected for many miles downwind. Little information is currently available concerning cumulus-cloud initiation, and it is hoped to gather further information in this area. Keystone burns 600 tons per hour of coal, which gives rise to some 20 tons per hour of SO2 emitted in the stack gases. (Upadhyaya-Vanderbilt)
W70-10218

WASTE HEAT DISPOSAL FROM POWER GENERATING STATIONS,
Federal Power Commission, Washington, D.C.
For primary bibliographic entry see Field 05D.
W70-10219

EFFECTS OF CLEAR-CUTTING ON STREAM TEMPERATURE,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 04C.
W70-10248

BIOLOGICAL SYSTEMS AS POLLUTION MONITORS,
Virginia Polytechnic Inst., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 05A.
W70-10273

MERCURY IN GREAT LAKES FISH,
Bureau of Commercial Fisheries, Ann Arbor, Mich.
Harry L. Seagran.
Linnos, Vol 3, No 2, p 3-10, 1970. 2 fig.

Descriptors: Heavy metals, *Great Lakes, *Public Health, Water pollution effects, Water pollution sources, Fish harvest, Inspection, Legal aspects, *Monitoring, On-site investigations, Industrial wastes, Pulp and paper industry, Pulp wastes, Economic impact, Lake Huron, Lake Erie.
Identifiers: *Recommendations, *Mercury, Fishing closures, Chlor-alkali plants, Minamata disease, St. Clair River.

This article summarizes statements by public agencies and the private sector dealing with mercury contamination introduced before the Subcommittee on Energy, Natural Resources and the Environment of the Senate Committee on Commerce. The development of the current situation, sources of contamination, background on mercury contamination, economic assessment of losses due to mercury contamination, a description of current BCF research, and a list of recommendations are discussed. The recommendations stress the need to identify all sources of mercury pollution and determine the fate and toxic effects of mercury in the environment. (See also W70-10322) (Katz-Washington)
W70-10321

THE MERCURY THREAT: QUESTIONS TO CONSIDER,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
Richard Copeland.
Limnos, Vol 3, No 2, p 11-13, 1970. 2 fig.

Descriptors: Heavy metals, *Great Lakes, Lake Erie (Geochemistry), Trace elements, Water pollution sources, Water pollution effects, Fungicides, Regulations, Lethal limit, Industrial wastes, Pulp and paper industry, *Pulp wastes, *Food chains, *Path of pollutants, *Public health persistence.
Identifiers: *Mercury pollution, Lake St. Clair, Chlor-alkali plants, Minamata disease, *Concentration mechanisms.

This paper discusses the basics of the mercury pollution problem. Mercury is used in industry in two forms, metallic mercury as an electrode in the production of chlorine and alkalis, and organic mercury compounds. The latter are as slimicides used in the pulping industry. Mercury is incorporated and accumulated in fish in two ways. Via the gills as an equilibrium is set up between mercury in fish and water. The second method is ingestion of mercury contaminated food. The author gives a calculated guess as to how long a mercury polluted environment will stay polluted after stopping mercury input. In the case of the Lake Erie - St. Clair system an estimate of 10-100 years is given. (See also W70-10321) (Katz-Washington)
W70-10322

A SHORT HISTORY OF MINAMATA DISEASE RESEARCH AND THE PRESENT SITUATION OF MERCURY POLLUTION IN JAPAN,
Tokyo Univ. (Japan). Dept. of Sanitary Engineering.
Jun Ui.
Nordiskt symposium Kring Kvicksilverproblematiken, held in Lidingo, Sweden, 10-11, Oct. 1968, No 2, Band 50, 1969, Nordiskt Hygienisk Tidskrift, p 139-146. 20 ref, 4 fig.

Descriptors: *Public health, Heavy metals, History, Industrial wastes, On-site investigations, Water pollution effects, Water pollution sources, Fungicides, Toxicity, Diseases.
Identifiers: *Minamata disease, *Mercury pollution, Japan, Acetaldehyde synthesis, Disease symptoms.

The discovery of Minamata Disease and its cause are documented. It is caused by consuming fish and shellfish which contain low-molecular normal alkyl mercury. The source of mercury pollution was the Minamata Factory which used mercury in the acetaldehyde synthesis process. The symptoms of the disease, mainly impairment of motion, speech, sensation, vision, and hearing are described and quantified. The Japanese have realized their problem and are now trying to alleviate all mercury pollution. (Katz-Washington)
W70-10323

COPPER, IRON, MANGANESE, AND ZINC CONTENT OF OYSTER (CRASSOSTREA ANGULATA) FROM THE COASTS OF CADIZ (IN SPANISH),
Instituto de Investigaciones Pesqueras, Cadiz (Spain).

Rafael Establier.
English summary. Investigacion Pesquera, Vol 33, No 1, p 335-343, 1969. 3 tab, 2 fig, 5 ref.

Descriptors: *Copper, *Iron, *Manganese, Heavy metals, Oysters.
Identifiers: *Zinc, *Crassostrea Angulata Spain, Cadiz coast, Cadiz Bay.

Oysters from the area around Sanlucar de Barrameda have a high concentration of Cu and Zn, whereas those from Cadiz Bay, Sancti-Petri, and Barbate contained less Cu and Zu than did the others. The average concentration of Cu, Fe, Mu and Zu in the oysters from various localities is tabulated. (Katz-Washington)
W70-10324

THE EFFECTS OF INDUSTRIAL WASTES OF MEMPHIS AND SHELBY COUNTY ON PRIMARY PLANKTONIC PRODUCERS,
Christian Bros. Coll., Memphis, Tenn.
R. Staub, J. W. Appling, A. M. Hofstetter, and I. J. Haas.
Bio Science, Vol 20, No 16, p 905-912, 1970. 4 fig, 3 tab, 10 ref.

Descriptors: *Water pollution effects, *Industrial wastes, Tennessee, Mississippi River, *Bioindicators, *Plankton, Diatoms, Correlation analysis, Phytoplankton, Chlorides, Chromium, Hardness (Water), Environmental effects, Biochemical oxygen demand, *Water temperature, Hydrogen ion concentration, Dissolved oxygen, Carbon dioxide, Silica, Turbidity, Manganese, Iron, Copper.
Identifiers: Memphis, Sky cover, Pennate counts, Centric counts, Diversity indexes.

Use of plankton analysis as an indicator of degree of pollution in a complex aquatic community is a promising area of investigation because of the role of plankton as primary producers. Correlation studies have indicated that water temperature is the major controlling influence in regulating both kinds and numbers of individuals. The iron content of the water samples surveyed had the next highest correlation with plankton numbers, and it was a consistently negative correlation. Turbidity of the waters sampled likewise showed considerable negative correlation with numbers of plankton. Total hardness (calcium and magnesium) and chloride content showed good correlation with numbers of plankton positive organisms. No significant correlations were found for copper, carbon dioxide, and chromate content of the water with or sky cover in relation to number of organisms. Very few significant correlations were obtained for dissolved oxygen, manganese or silica content, or for pH. However, given a sufficient run, or flow, through relatively nonpolluting regions, and a natural dilution (increase in volume), a stream can greatly improve its quality by development and activity of its plankton community. (Katz-Washington)
W70-10325

HEMATOLOGICAL EFFECTS OF APHOLATE ON CHANNEL CATFISH (ICTALURUS PUNCTATUS),
Mississippi Univ., Jackson. Dept. of Biochemistry.
Charles L. Dodgen, and Sue Sullivan.
Proceedings of the Society for Experimental Biology and Medicine, Vol 131, p 124-126, 1969. 10 ref, 2 tab. USPHS Grants EF 00438, ES 00137, and CC 00271.

Descriptors: *Channel catfish, Fishkill, *Fish physiology, Bioassay, Toxicity, Lethal limit, Mode of action.
Identifiers: *Apholate, Alkylating agents, *Hematological effects, Erythrocyte counts, Leukocyte counts, Thrombocytes, *Blood cell counts, Histological examination.

Channel catfish fingerlings were given oral doses of apholate, 200 mg/kg and 400 mg (Apholate/kg body weight), an alkylating agent. Total erythrocyte, total leukocyte, and differential leukocyte counts were made to determine hematological changes produced by apholate. The changes in erythrocyte counts of animals receiving apholate at both levels were not significantly different from the control. The total leukocyte counts were significantly lower in the treated fish. There was less of an effect upon the thrombocytes. The lower dose used in the experiments approximates the LD50 of 191 mg/kg, determined at 14 days post-treatment. The LD50 decreases to 124 mg/kg at 30 days, but no deaths occurred in less than 8 days, regardless of dose. (Katz-Washington)
W70-10327

ESTUARINE MEASUREMENTS FOR PRODUCTIVITY AND EVALUATION OF SYSTEM WASTE DISCHARGE EFFECTS,
Texas Univ., Austin.
E. M. Davis, and W. W. Eckenfelder.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint. 9 p, 6 fig, 2 tab, 10 ref.

Descriptors: *Estuaries, *Productivity, *Photosynthesis, *Respiration, Water pollution effects, Chlorophyll, Diurnal distribution, Dissolved oxygen.
Identifiers: Species diversity index.

The overall productivity of two estuarian systems on the Texas coast, namely Taylor Bayou and Chocolate Bayou, was evaluated and the seasonal effects of chemical waste discharges on the ecology of the systems was estimated. The variation of productivity by season of the year over a two-year period was established by field analysis which included the measurement of gross photosynthesis and respiration and the species diversity index in each system. These results were compared to laboratory data using waste samples taken from each estuary. It was established that the community productivity and the effects of additions of chemical process wastes could be determined under laboratory conditions. Chlorophyll-a response varies with the population quite extensively and can increase due to phytoplankton increases. The nutritive benefit is therefore quite rapid for some wastes. Even with increases of chlorophyll-a concentrations some photosynthetic supression may occur due to a concurrent toxic effect by the waste. Diversity indexes decreased most often due to the toxic effect of the wastes on the zooplankton. The dinoflagellates are more seriously effected, followed by the green algae, diatoms then bluegreens. Application of the principles involved herein are by no means limited to the estuaries of Texas coast, and may be applied to any aquatic ecosystem regardless of the hemisphere in which it is located. (Hancuff-Texas)
W70-10401

NUTRIENT REGENERATION IN LAKES AND OCEANS,
Georgia Univ., Athens. Dept. of Zoology.
R. E. Johannes.
Advances in microbiology of the sea, Academic Press, New York, 1968. Vol 1, p 203-213. 1 fig, 1 tab, 68 ref.

Descriptors: *Nutrients, *Lakes, *Oceans, *Organic matter, *Decomposing organic matter, Nitrogen, Phosphorus, Aquatic plants, Aquatic animals, Ecosystems, Food chains, Zooplankton, Bacteria, Detritus, Herbivores, Carnivores, Phytoplankton, Georgia, New York, Rhode Island, Metabolism.
Identifiers: *Nutrient regeneration, Long Island (N Y), Doboy Sound (Ga), Narragansett Bay (R I), Cayuga Lake (N Y), Cape Breton Island (Canada).

Nutrient regeneration is defined as the release of soluble organic or inorganic plant nutrients by or from organisms or their remains. This discussion is limited to nitrogen and phosphorus. It has been demonstrated that most nitrogen and phosphorus incorporated into aquatic plants and animals is usually regenerated by processes other than direct bacterial action. Nutrient regeneration rates and bacterial numbers are not correlated. Bacteria are instrumental in nutrient regeneration indirectly by converting detritus into a form utilizable by bacteria-feeders. It is these bacteria-feeders which appear to accomplish much of the nonautolytic regeneration of nutrients from detritus. Pathways of phosphorus and nitrogen flow in aquatic ecosystems are generally dominated by grazing food chains; much of the phosphorus and nitrogen assimilated by plants is subsequently ingested, metabolized and released in soluble forms by zooplankton. A substantial remainder is released from organiz detritus by autolysis and solution. Bacteria facilitate nutrient regeneration from residue by assimilating detrital nutrients, thus rendering them available to bacteria-feeders which subsequently excrete them. Bacteria appear to account directly for only a minor fraction of nutrient regeneration and at times actually compete with plants for nutrients. (Jones-Wisconsin)
W70-10404

THE EXTENT OF NITROGEN AND PHOSPHORUS REGENERATION FROM DECOMPOSING ALGAE,
Kentucky Univ., Lexington. Dept. of Civil Engineering; Texas Univ., Austin. Dept. of Civil Engineering; and Stanford Univ., Calif. Dept. of Environmental Engineering.
E. G. Foree, W. J. Jewell, and P. L. McCarty.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint. 15 p.

Descriptors: *Eutrophication, *Algae, *Decomposing organic matter, Nutrients, Surface waters, Nitrogen, Water quality, Phosphorus, Aerobic conditions, Anaerobic conditions, Chlorella, Chlamydomonas, Scenedesmus, Effluents, Oxidation lagoons.
Identifiers: San Pablo Estuary (Calif), Sacramento River (Calif), Searsville Lake (Calif), San Joaquin River (Calif), Nitzschia.

Decomposition of monospecific and heterogenous algae and subsequent release of nutrients were investigated in dark-aerobic and dark-anaerobic cultures. Under aerobic conditions, 50% on the average of the initial particulate nitrogen and phosphorus were regenerated, but the recovery varied from zero to nearly 100%. Under anaerobic conditions, the average regeneration of nitrogen and phosphorus was 40% and 60%, respectively, with variation nearly as great as that for aerobic decomposition. A general agreement between equation-predicted nitrogen and phosphorus refractory values and measured values was obtained. The results suggest that chances for a successful control of eutrophication are much greater before refractory remains of algae have been permitted to accumulate. (Wilde-Wisconsin)
W70-10405

DE ROCHE V OSBORNE (POLLUTED WATER EVEN WITHOUT CONTAMINATED CLAMS JUSTIFIES CLOSING CLAM BEDS TO COMMERCIAL DIGGING).
For primary bibliographic entry see Field 06E.
W70-10448

5D. Waste Treatment Processes

MICROBIAL RELEASE OF SOLUBLE PHOSPHATE IN AN ACTIVATED SLUDGE ENVIRONMENT,
Virginia Polytechnic Inst., Blacksburg. Dept. of Civil Engineering.
Clifford W. Randall.
Available from NTIS as PB-194 453, $3.00 in paper copy, $0.65 in microfiche. Completion Report, August, 1970. 10 p, 6 ref. OWRR Project A-024-VA (1).

Descriptors: *Water pollution control, *Waste water treatment, *Biological treatment,

*Phosphates, *Phosphorus, Oxygen, Sewage effluents, Sludge, *Activated sludge, Hydrogen-ion concentration, Oxidation-reduction potential.

Batch type laboratory units were used to study the mechanisms and factors that determine the amount of soluble phosphate that will be released from activated sludge during typical plant operation. In addition to studying the effect of typical operational factors such as rate and duration of aeration, organic loading rate, and duration of anaerobiosis, emphasis was placed on determining whether activated sludge phosphate release is primarily a chemical or a biological phenomenon. The experimental results demonstrate that the release of soluble phosphate from activated sludge is basically a biological phenomenon and that it is relatively independent of the chemical environment as measured by pH and ORP, within the normal range of waste treatment operation. Such release is a strong function of parameters that affect cellular metabolism such as D.O. The release of phosphate occurs under both aerobic and anoxic conditions but the amount released during anoxia is considerably greater and it is released much more rapidly. The magnitude and rapidity of release under any conditions is directly proportional to the biological stress imposed on the system. Release during anoxia can be retarded by preceding high aeration rates and significant amounts of organic substrate.
W70-10112

ENHANCEMENT OF WATER QUALITY USING FOREST-DERIVED COAGULATING SYSTEMS. PART I. THE COAGULANT AND DISPERSANT CHARACTERISTICS OF LIGNOSULPHONATES,
Washington Univ., Seattle. Inst. of Forest Products.
G. G. Allan, and D. D. Halabisky.
Pulp and Paper Magazine of Canada, Vol 71, No 2, p T50-T56, January 16, 1970. OWRR Project A-019-WASH.

Descriptors: *Wastewater treatment, *Water quality, *Pulp wastes, Lignins, Kaolimite, Pulp and paper industry, *Coagulation.
Identifiers: Lignosulfanates.

Lignosulphonates isolated directly from pulp waste liquor are shown to function as dispersants or coagulants depending on their molecular weight. The high molecular weight material (i.e., equal or greater than 0.15 dl./g.), in association with alum is a more effective combination for the removal of colloidal pollutants from water than alum alone. Coagulation mechanisms are discussed, and evidence is presented to show that after reduction of the zeta potential of the contaminant particles by the alum, the large lignosulfonate macromelecules create fast settling flocs by interparticular bridging. (See also W70-10115)
W70-10116

NITRATE REMOVAL FROM ACTIVATED SLUDGE SYSTEMS,
Washington Univ., Seattle. Dept. of Civil Engineering.
Dale A. Carlson.
Available from NTIS as PB-194 457, $3.00 in paper copy, $0.65 in microfiche. Completion Report, July 15, 1970. 35 p, 7 tab, 7 fig, 37 ref. OWRR Project A-026-WASH (1).

Descriptors: *Nitrification, *Denitrification, Water quality control, Eutrophication, *Activated sludge, *Waste water treatment.
Identifiers: *Nitrate removal.

Pilot plant studies of nitrification-denitrification in activated sludge facilities treating domestic waste waters provided equations and printouts for design of nitrification and denitrification units. For nitrification tank design, a computer program and printouts were developed which present the equation in graphical form to facilitate use. The equation printouts provide minimum retention times necessary to achieve consistent nitrification. The oxygen requirement for full nitrification was 4 mg/l and the percent nitrification dropped with loading factors above 0.2 lb BOD5 per day per pound of mixed liquor suspended solids. In the denitrification unit the percent nitrate removal diminished with increasing dissolved oxygen supporting the theory that complete anaerobiosis is necessary for maximum denitrification. The rate of nitrate removal was directly dependent on the mixed liquor volatile suspended solids concentration of the denitrifying. The denitrification equation developed defines the minimum sludge concentration necessary for complete reduction of nitrates. While the constants in the equation solutions are gased on all weather conditions in the Pacific Northwest, a method for evaluating equation constants provides the means of applying the equation to any location.
W70-10118

EVALUATION OF PYRRONES AS MEMBRANES,
Franklin Inst. Research Labs., Philadelphia, Pa.
H. Scott, and F. L. Serafin.
Available from NTIS as NASA CR-1648, $3.00 in paper copy, $0.65 in microfiche. NASA CR-1648, September 1970. 35 p, 8 tab, 15 fig, 10 ref. NASA Contract NASl-8609.

Descriptors: *Membranes, *Waste water treatment, Membrane processes, *Reverse osmosis, *Osmosis, *Absorption, Plastics, Films, Desalination.
Identifiers: Polymidazopyrrolones, Pyrrones, Urine purification, *Polymers.

The facile absorption of water by polyimidazopyrrolones (Pyrrones) suggested a feasibility study to use films of the polymers as membranes for the purification of water by reverse osmosis. Direct osmosis measurements of water, salt, and urea fluxes through Pyrrone membranes are described. The data indicate comparable flux values and superior water-to-salt permeabilities of the Pyrrones relative to symmetric cellulose acetate membranes. Coupled with better mechanical strength and chemical resistance, these results suggest that the successful fabrication of asymmetric Pyrrone membranes could lead to substantial improvements over asymmetric cellulose acetate, from which the best reverse osmosis membranes are currently prepared.
W70-10125

ALGAL RECORDS FOR THREE INDIANA SEWAGE STABILIZATION PONDS,
Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
C. Mervin Palmer.
Proceedings of the Indiana Academy of Science, Vol 78, p 139-145, 1968. 3 tab, 8 ref.

Descriptors: *Sewage lagoons, *Algae, *Sewage treatment, *Indiana, Chlorophyta, Cyanophyta, Diatoms, Seasonal, Euglena, Chlamydomonas, Chlorella, Scenedesmus, Sampling, Oxydation lagoons.
Identifiers: Blue-green algae, Nitzschia, Biological studies, Algal identification.

Three sewage stabilization ponds in southeastern Indiana were among several throughout the United States selected for biological studies, with particular emphasis on the algal flora. Algal identifications have been recorded from 376 samples collected from the ponds during a period from May 1962 to August 1968. Although certain genera were found frequently in all three ponds, each pond had a distinctive algal flora. Green algae were invariably the most abundant; however, flagellates were also prominent. Of a total of 64 genera of the most significant and abundant algae there were 29 green algae, 19 flagellates, 10 blue-green algae, and 6 diatoms. Some genera were limited to the summer season, while others were most prominent in spring and fall or in winter. The pollution-tolerant algae, Euglena and Nitzschia, were abundant and persistent in all three ponds. The biochemical oxygen demand at the intakes was about 500 ppm and for the effluents less than 50 ppm. The first virus infecting a blue-green alga was isolated from one of the ponds in Ripley County. (Jones-Wisconsin)
W70-10173

FILTRATION OF ALGAL SUSPENSIONS,
Bohna Engineering and Research Inc., San Francisco, Calif.
I. J. Wright, and W. M. Luiz.
Bohna Engineering and Research, Incorporated, San Francisco, California, Bohna Internal Report F170, 1970. 31 p, 7 fig, 10 tab.

Descriptors: *Waste water treatment, *Filtration, *Algae, *Suspension, Harvesting, Ponds, California, Scenedesmus, Suspended load, Nitrates, Calcium carbonate, Proteins, Filters, Engineers estimates, Economics, Feasibility, Costs, Annual costs, Pilot plants.
Identifiers: Firebaugh (Calif), Volatile solids, Sanborn filter, Backwashing.

The Sanborn Filter, proprietary of Bohna Engineering and Research, Inc, a fabric and granular-media device, has been evaluated for use in harvesting algae from ponds of the Agricultural Waste Water Treatment Center at Firebaugh, California. Removals of up to 98% have been achieved without the use of flocculants or other chemical additives. The backwash from the filter has suspended solids concentrations up to 1.7% which shows evidence of increased coagulation, allowing the concentration of solids to a level of 8% to 12% by simple sedimentation. An economic analysis of the use of algae for nitrogen stripping of San Joaquin Valley drainage water was made. Assuming a flow sheet which includes lined, mixed growth ponds followed by filtration with the Sanborn Filter, concentration of the backwash by sedimentation or centrifugation and air drying of the algae, an approximate total cost of $37.01 per million gallons treated is projected, based on amortization and interest charges of 10% per year of the initial investment. Capacity of 700 million gallons per day was assumed. (Jones-Wisconsin)
W70-10174

WATER QUALITY BEGINS AT THE LOCAL LEVEL,.
American Chemical Society, Washington, D.C.

Environmental Science and Technology, p 281-282, Vol 4, No 4, April 1970. 2 fig.

Descriptors: *Treatment facilities, Industrial wastes, Hydrologic budget, Sewage treatment, Lake Erie, Waste water treatment.
Identifiers: *Cleveland, Cuyahoga River.

Since the adoption of a $100 million water bond issue in November 1968, Cleveland, Ohio has been modernizing existing sewage treatment plants and making plans for the expansion and renovation of its entire waste water treatment program. Cleveland's Clean Water Task Force, set up in January 1969, has directed its attention toward three crucial areas: updating the city's three treatment plants and designing a new treatment unit for one of the plants which will substitute physical-chemical treatment for biological treatment, designing a new sewage collection and transportation network, and encouraging joint industrial-municipal treatment schemes. (Holmes-Rutgers)
W70-10177

CONTROL OF THERMAL EFFECTS AT BEAVER VALLEY STATION,
Duquesne Light Co., Pittsburgh, Pa.; Worcester Polytechnic Inst., Mass; and Stone and Webster Engineering Corp., Boston, Mass.
Robert J. McAllister, Lawrence C. Neale, and Bruno Brodfeld.
Journal of the Power Division, Proceedings of ASCE, Vol 96, No PO3, Proc Paper 7319, June, 1970, p 287-298. 9 fig.

Descriptors: *Thermal pollution, *Cooling towers, Effluents, Jets, Mixing, Powerplants, Rivers, Temperature, Flumes, Froude number, Outlets, Waste dilution.
Identifiers: Entrainment.

By combining a once-through condenser water system with a supplemental cooling tower, the required temperature criteria can be met in the operation of Beaver Valley Station, even for the minimum discharge. On the average cooling tower assistance is necessary only two to three months each year, but not continuously. A feature of the site is the local configuration of Ohio River which branches into a main navigable channel and a smaller back channel, with the plant outlet located on the river. Field studies and model tests were carried out to investigate means for improving river flow distribution. The model comprised approximately a 2-mile reach of the river at a horizontal scale of 1:125 and a vertical scale of 1:25. It was found that the outlet orientation could be optimized to ensure maximum river flow entrainment into the back channel by the discharged jet. Analysis and tests results showed that warm water recirculation between discharge and intake structures would be adequately controlled by increasing effluent dilution in the back channel. Temperature patterns at the surface and in cross sections were determined on the model for a two mile long river beach. (Upadhyaya-Vanderbilt)
W70-10215

WASTE HEAT DISPOSAL FROM POWER GENERATING STATIONS,
Federal Power Commission, Washington, D.C.
F. S. Brown.
Journal of the Power Division, Proceedings of ASCE, Vol 96, No PO3, Proc Paper 7317, June, 1970, p 277-286.

Descriptors: *Thermal pollution, *Cooling water, Condensers, Cooling towers, Thermal powerplants, Water quality.
Identifiers: *Waste heat.

Steam-electric plants, nuclear or fossil fueled, are expected to provide the bulk of the growing needs for electric energy. As part of the operating cycle, such plants require large flows of water through the condensers to convert the exhaust steam to water. The condenser cooling water absorbs large amounts of waste heat which must be dissipated in some manner. The types of cooling systems in use include once through, cooling ponds, and cooling towers of either mechanical or natural draft design. Cooling towers are used where water supplies are limited or water quality standards prevent use of streams or lakes for waste heat disposal. Cooling towers add to power costs and are aesthetically undesirable. The addition of heat to water bodies may produce adverse effects on aquatic organisms. Although substantial studies have been completed or are under way, additional research is needed on the waste heat disposal problem. Areas of necessary research include the biological effects, the transport and behavior of heat in water, improved methods of cooling, and means of making beneficial use of waste heat. (Upadhyaya-Vanderbilt)
W70-10219

TECHNICAL NORMS FOR COMPUTATION OF COOLING PONDS (In Russian).

Gosudarstvennoe Energeticheskoye Izdatel'stvo, Moscow, 1963. 103 p, 13 fig.

Descriptors: *Cooling, Ponds, Temperature, Heat balance, Heated water, Evaporation, Convection, Energy transfer, Thermal stratification, Heating, Water cooling, *Thermal powerplants, *Thermal pollution, Radiation.
Identifiers: *Cooling ponds.

The norms presented here are determined for the practical design of cooling ponds serving steam-electric power plants. The cooling ponds are classified according to purpose, hydrological conditions, design parameters, and exploitation. As to hydraulic design the ponds can be divided into two groups: (a) ponds with a great degree of B/Bo ratio, (B-width of pond, Bo-width of intake), and (b) ponds with a small B/Bo degree. A critical ratio is B/Bo—6. The norms present a means of computation of active cooling surface area and active cooling specimen volume of the pond. The temperature computation uses the energy budget approach and presents all formulae necessary for temperature and temperature decay computations. An example of the computation of a cooling pond is solved and presented. (Novotny-Vanderbilt)
W70-10223

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 1.
W70-10267

ELECTROPHORETIC CLARIFICATION OF WATER,
Texas A and M Univ., College Station. Water Resources Inst.
E. A. Hiler, and W. M. Lyle.
Available from NTIS as PB-194 566, $3.00 in paper copy, $0.65 in microfiche. Texas A and M University, Water Resources Institute Technical Report No 31, August 1970. 127 p, 9 tab, 37 fig, 28 ref. 2 append. OWRR Project A-009-TEX (2).

Descriptors: *Water treatment, *Water purification, *Tertiary treatment, Pesticide removal, Filtration, Desalination, *Waste water treatment, *Electrophoresis, *Electrochemistry, Electrolysis, Physicochemical properties, Chemical reactions, Water chemistry, Analytical techniques.

The direct use of electric currents and electric fields to bring about water clarification and purification was investigated. Electrophoretic and electrochemical systems appear well adapted for removal of these electrically charged pollutants and in addition have the potential of being entirely automated. Numerous design concepts are advanced and tested through the use of laboratory models. These include a parallel plate model which was designed entirely for electrophoretic removal, and porous filter and electrode grid models which incorporated both electrophoretic and electrochemical capabilities. Successful water clarification was attained with the parallel plate model only when the influent water was of very low electrical conductivity. Electrolysis products at high conductivities caused sufficient turbulence to completely disrupt electrophoretic transport. In addition, primary and secondary chemical reactions took place due to electrolysis, which altered the characteristics of the suspension. It was also concluded that the ease of automation with an electrophoretic system does not justify the high cost of water treatment by this method. Water purification by electrochemical means overcame this problem and was successful both operationally and economically. As a result of the experimental testing, an example design of a small semiautomated electrochemical water system is offered which incorporates electrochemical flocculation, settling and electrochemical disinfection operations.
W70-10314

TASK I REPORT: SURVEY OF LARGE-SCALE HEAT REJECTION EQUIPMENT,
Dynatech R/D Co., Cambridge, Mass. Thermal Engineering Group.
For primary bibliographic entry see Field 05G.
W70-10315

AUTOMATIC WATER AND WASTE TREATMENT PLANTS IN OPERATION,
Stone (Ralph) and Co., Inc., Los Angeles, Calif.
Ralph Stone, and E. T. Conrad.
Civil Engineering, American Society of Civil Engineers, Vol 40, No 5, p 37-40, May 1970. 4 fig, 2 tab.

Descriptors: *Sewage treatment, *Water treatment, *Activated sludge, Filtration, Chlorination, Oxidation, Aeration, Cost, Waste water treatment, California.
Identifiers: *Napa-Berryessa Improvement District, *Automatic control, Clarification.

Water and waste treatment for the Napa-Berryessa Improvement District and Lake Berryessa in California depend on an automatic system. The water facilities are an intake structure; treatment plant which provides for taste, odor, and pH control clarification, filtration and chlorination; pump station; 7,000 ft transmission main; storage tank; and distribution system. The entire water system is controlled automatically using water levels at various points to start and stop the intake and booster pump stations. The intake pumps are mounted on a carrier and move up and down with the lake level. The system was designed for peak flows of 0.5 mgd, expandable to 1.0 mgd and ultimately to 4.0 mgd. The sewage facility treats a load of 0.175 mgd with easy expansion to 0.35 mgd incorporating an activated sludge plant followed by oxidation basins. Two booster pumps, controlled automatically by the level in the oxidation basin, pump the effluent to the disposal area. The treated waste is disposed through hillside irrigation employing 80 acres with natural slopes up to 1:1. The land was divided into four subdivisions, three sections intermittently irrigated by automatically controlled 50,000 gal storage tank, and the fourth section allowed to fully dry between dosings. Drainage ditches and a collection pond prevent contamination of lake waters. The total construction cost was $735,644 with $32,324 going for the automatic control system. (Sorber-Texas)
W70-10328

WATER REUSE AND RECYCLING IN INDUSTRY,
Engineering-Science, Inc., Austin, Tex.
J. Eller, D. L. Ford, and E. F. Gloyna.
Journal of the American Water Works Association, Vol 62, No 3, p 149-154, March 1970. 5 fig, 3 tab, 19 ref.

Descriptors: *Industrial water, *Water reuse, *Economics, Municipal waste water, *Cost analysis industries, Tertiary treatment, Pollutants, Waste water treatment.
Identifiers: *Water recycle.

The current status of industrial water reuse and recycling was surveyed by a presentation of representative case studies. In the majority of cases involving industrial reuse it is necessary to provide some form of treatment and several industries are using several forms of tertiary treatment in support of water reuse and recycle practices. Particular emphasis is placed on reuse of municipal waste waters by selected industries. An economic balance equation on water reuse was discussed and a simplified model establishing a basis for making economic decisions presented. (Waid-Texas)
W70-10329

TERTIARY TREATMENT OF WASTE WATER,
Michigan State Univ., East Lansing. Div. of Engineering Research.
K. L. Schulze.
Developments in Industrial Microbiology, Vol 9, p 175-185, 1968. 6 fig, 2 tab, 21 ref.

Descriptors: *Phosphates, *Waste water, *Waste water treatment, *Tertiary treatment, Coagulation, Electrodialysis, Reverse osmosis, Protozoa, Rotifers, Annelids, Activated carbon, Adsorption.
Identifiers: *Lake Tahoe Public Utility District, *Santee Valley, *Lebanon, Ohio, Epiphyton.

Using data obtained from continuous flow culture of bacteria, it was demonstrated that secondary waste water treatment processes are inherently incapable of attaining high grade removal of nutrients, especially nitrogen and phosphorus compounds. Activated sludge plants have maximum removal capability of 49% for nitrogen and 33% for

phosphate related to primary effluent. This necessitates the development of tertiary treatment. A survey of the physico-chemical and biological tertiary treatment methods and their results were presented. Special emphasis was placed on an attempt to assess the possibility of large scale nutrient removal by biological means. Pilot plants at Lebanon, Ohio and full scale operations at Santee Valley and Lake Tahoe Public Utility District plants in California were described. It is suggested that combination of a tertiary treatment slip with irrigation for crop production be used as a possible solution. It is urged that industry substitute another detergent filler for phosphates. (Waid-Texas)
W70-10331

THE CROSSNESS SEWAGE TREATMENT WORKS, GREATER LONDON COUNCIL: FIVE YEARS OPERATION 1963-68,
R. W. Horner, J. V. Stedman, F. G. Stark, and R. Davis.
Water Pollution Control, Vol 69, No 2, p 180-194, March-April 1970. 4 fig, 7 tab, 3 ref.

Descriptors: *Activated sludge, *History, *Sewage treatment, *Settling basin, *Screens, Sludge treatment, *Disposal, Performance, Biochemical oxygen demand, Waste water treatment.
Identifiers: *Extension, Detritus channels, London (England).

The operation and the basic design of sewage treatment works at Crossness, London are discussed. The new works was designed to handle a flow of 100 mgd in dry weather and a maximum flow of 216 mgd. The activated sludge plant is designed to treat a flow of 72 mgd to a 30:20 standard. Considering the heavy loading during storms, the performance of the six low level and four high level screens have been satisfactory. The grit removed from the detritus channels averages 121 cu yd/week. An improvement in the quality of the settled sewage coincides with the improved performance of the activated sludge plant. Primary sedimentation tanks are now capable of producing 120 mg/l SS when treating the dry weather flow. Performance of the activated sludge plant during the first and second year of operation is described. During the second year the treatment exceeded the design flow and difficulties were encountered due to overloading. The performances of primary and secondary sludge digestion are also presented. In general, the plant has operated well despite minor difficulties. (Shankar-Texas)
W70-10332

CITY OF OXFORD: EXTENSION TO SEWAGE-TREATMENT WORKS,
Oxford (England).
A. T. Morris, C. E. Copeland, and V. H. Lewin.
Water Pollution Control, Vol 69, No 3, May-June 1970, p 249-268. 7 fig, 5 ref.

Descriptors: *Sewage treatment, *Design, Effluent, Tertiary treatment, Biochemical oxygen demand, Sludge, Digestion, Organic loading, Dissolved oxygen, Sampling, Waste water treatment.
Identifiers: *Extension, *Clariflocculator tanks, *Storm sewage, Suspended solids, Flood lighting, Blower house, Magnetic flow meters, Automatic sampler, Oxford (England).

The sewage treatment works in the city of Oxford was originally designed to treat 5 mgd dry weather flow (dwf) from a population of 110,000 and to produce an effluent complying with a 30:20 standard. The extension has been designed for a dwf of 10 mgd from a population of 132,000 using an equivalent water consumption of 75 gal/hd d. The activated sludge process continued to be the best method, but to improve flexibility, and production of high quality effluent, additional parallel lanes of treatment were considered to be essential. Provisions for dealing with storm sewage was anticipated for this section of the extension. Other new features are rapid gravity sand filtration, rectangular secondary sludge digestion tanks and facilities for the separate consoldiation of surplus activated sludge. A sketch of the new primary and storm-sewage/balancing tanks, activated sludge plant the new final separating tanks are presented. Ram pumps deliver the sludge to the existing elutriation tanks after which it is pumped to the vaccum filtration plant for dewatering. Liquid sludge is distributed to farm land as a soil conditioner. Sewage flows and final effluent are measured by standing-wave flumes. (Shankar-Texas)
W70-10333

TANK CLEANING STATIONS FOR TANKERS,
Societe des Eaux de Marseille (France).
G. Bossy.
Fifth International Water Pollution Research Conference, San Frncisco, July 26-August 1, 1970. Preprint, Paper III-14, 6 p, July-August 1970. 2 tab, 2 ref.

Descriptors: *Water pollution control, *Oils, *Waste disposal, *Stations, Waste water treatment, Oil wastes, Cost.
Identifiers: *Tanks, *Oil tankers, Rinsing.

Ocean pollution by hydrocarbons results mainly from (1) accidental causes: due to errors in manoeuvering, collisions, grounding, acts of war, fracture of pipe lines, and (2) systematic causes: on which action is possible, i.e., draining the holds of cargo vessels, trawlers, liners, lubricant oil, draining on vessels, rinsing and unloading ballast water from tankers. After vessels unload, there actually remains 0.4% of the load in the tanker, formed by residues sticking to the tank walls. For many years, these residues, which tankers must get rid of for reasons of maintenance and security, have been evacuated into the sea by the use of rinsing water. The quality of residues ejected on all seas, and particularly into the Mediterranean Sea and the Atlantic Ocean, may be estimated at some 3 million tons a year. A tank cleaning station should be situated in a region of intense pretrochemical activity and in a tanker repair port. An example is the Marseilles station which is located in the port installations. It has a 90 m long quay with a draught of 10 m where tankers of up to 100,000 tons can be moored. An area of some 25,000 sq meters is available, with a treatment capacity of 12000 t/h. The station offers facilities for cleaning and degasifying tankers, coasters, tank wagons and trucks. The residues, slop, rinsing water, are separated. The hydrocarbon mixture receives treatment to raise its flashpoint. The station is equipped with a permanent separator tank, 2 reception tanks, 1 tank for treatment, 1 extractor, and storage tanks. (Hancuff-Texas)
W70-10334

A MATHEMATICAL MODEL FOR THE WET-AIR OXIDATION OF SLUDGE,
Kyoto Univ. (Japan). Faculty of Engineering.
T. Takamatsu, I. Hashimoto, and S. Sioya.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-32, 8 p, July-August 1970. 7 fig, 1 tab, 5 ref.

Descriptors: *Mathematical models, *Oxidation, *Sludge, *Sludge treatment, Chemical oxygen demand, Sewage treatment, Waste water treatment.
Identifiers: Decomposition.

It has been discovered that the wet-air oxidation of sludge is composed of two phenomena, that is, sludge decomposition without oxygen followed by the oxidation of the decomposed sludge by oxygen, at a temperature of 170 - 250 deg C and a pressure of 60 - 130 kg/sq cm-gauge. A mathematical model of this reaction process is proposed in terms of COD and weight of solid matter, soluble nonevaporative matter and soluble evaporative matter in sludge. The parameters involved in the mathematical model are estimated by a nonlinear estimation technique. Sludge is a highly complex mixture and the complexity of its composition makes it difficult to represent its thermal decomposition and oxidation in a mathematical form. As the mathematical model should be as simple as possible, the sludge content is roughly classified into four categories. They are: (1) solid matter, (2) soluble nonevaporative matter below 120 deg C, (3) soluble evaporative matter above 120 deg C, (4) pure water. Separate mathematical models are derived for the (1) thermal decomposition process, (2) relation between thermal decomposition and oxidation, (3) oxidation process. Experiments carried out by using artificially cultured activated sludge have verified that the model is applicable for the reaction of sewage sludge. Thus, it will become possible to control and design the wet-air oxidation process on a quantitative basis by using the mathematical model proposed here. (Hancuff-Texas)
W70-10335

BIOLOGICAL TREATMENT OF THERMALLY CONDITIONED SLUDGE LIQUORS,
Zimpro, Inc., Rothschild, Wis.
A. H. Erickson, and P. V. Knopp.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-33, 15 p, July-August 1970. 7 fig, 6 tab, 31 ref.

Descriptors: *Filtration, *Biological treatment, *Sludge, *Sludge treatment, Oxidation, Chemical oxygen demand, Mathematical models, Kinetic, Nitrification, Nitrogen, Efficiency, Performance.
Identifiers: Oxygen transfer, Mass balance.

Described are the results of biotreatment of thermally conditioned sludge liquors in their undiluted form with the purpose of: (1) defining the fraction of organic carbon (as CO COD) which is non-biodegradable. (2) determining yield and endogenous decay coefficient, (3) developing parameters for use in full scale design and cost estimating. The liquor for the biotreatments was prepared by processing approximately 2,000 gallons of mixed primary and waste activated sludge from the Stevens Point, Wisconsin sewage treatment plant (primary and activated sludge) through a 5 gallon per minute pilot plant thermal conditioning system. Two types of feed material were used representing two levels of thermal conditioning vis. 5-10% oxidation or low oxidation and 70% wet air oxidation or highoxidation. The feed COD concentration ranged from 7,000 to 12,200 mg/l BOD, nitrogen, phosphorus and pH showed similar variation. BOD5 removals in excess of 90% were accomplished at loading rates as high as 4.0 pounds BOD applied per pound of mixed liquor volatile suspended solids. The sludge solids yielded sludge volume indices in the range of 60-80mg/l suspended solids. Oxygen transfer rates were determined and for the system KL was correlated with superficial air velocity. Undiluted liquors will support growth of nitrifying organisms under loading conditions normally assumed to be required for nitrification oin activated sludge systems, i.e. loading rate less than .32 pounds BOD per pound MLVSS. (Hancuff-Texas)
W70-10336

THE EFFECT ON THE CHEMICAL CONTENT OF SEA WATER WITH A LIMITED EXCHANGE OF WATER FROM A LARGE OCEAN OF POLLUTING DISCHARGES OF CHEMICALS (WITH THE BALTIC SEA AS AN EXAMPLE),
Akademiya Nauk SSSR. Institut Okeanologii.
A. Simonov, and A. Justchak.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper III-12, 3 p, July-August 1970.

Descriptors: *Marine microorganisms, *Marine plants, *Oceans, *Chemical wastes, *Water pollution control, Discharge (Waters), Oils, Ammonia, Biochemical oxygen demand, Phosphorus, Waste water disposal, Industrial wastes.
Identifiers: *Baltic Sea.

The problem of preventing sea water pollution by industrial and domestic discharges is one of con-

siderable importance, since progressive pollution of sea water can result in a sharp deterioration of sanitary conditions and may cause considerable damage to the fishing industry. Discharges of pollutants are particularly dangerous when the receiving waters have low flushing characteristics due to their limited exchange capacity with the major adjacent ocean. The Baltic Sea is a typical example of this case. To date, the systematic investigation into the chemical pollution of the Baltic Sea has been quite limited. Because of this lack of information the Hydrological Service of the USSR decided to make a systematic study of the chemical composition of the waters in the Baltic Sea coastal areas. The data from these investigations includes the following: oil products, phenol, ammonia, organic substances, oxidizability, Biological Oxygen Consumption (BOC5), oxidic medium reaction, oxygen and biogenic substances. Under the influence of domestic and industrial discharges the following conclusions may be drawn: (1) the natural composition of sea water has changed over a period of years, this is reflected by the increase in ammonia, organic phosphorus and oxidizability levels, (2) oxygen deficiency in many coastal waters has been observed. (Hancuff-Texas)
W70-10337

TREATMENT OF PULP MILL EFFLUENTS ON SORPTION RESINS,
D. Ruzickova.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-34, 9 p, July-August 1970. 5 fig, 4 tab, 7 ref.

Descriptors: *Pulp and paper industry, *Effluent, *Sorption, Industrial wastes, Resins, Ion exchange, Testing, Sulfite liquors, Waste water treatment, Efficiency, Equilibrium.

The object of this study was to show the possibility of treating some types of pulp mill effluents by reversible sorption on sorption resins. The idea of utilizing the properties of sorption resins for the treatment of waste waters, polluted with organic, especially biochemically resistant substances, arose from findings in water treatment by demineralization. Anion exchange resins after long use inactivated by the irreversible linkage of some types of high-molecular organic compounds are only partially liberated during recovery. This fact is attributed to the low diffusion velocity of their voluminous organic molecules. For this reason one sometimes precedes ion exchange filters in demineralization plants with suitable sorption resin media, which permit efficient sorption and especially desorption of the high-molecular organic compounds. On the basis of preliminary tests conducted under static and dynamic conditions, it has been found that for the removal of organic pollution from pulp mill effluents (from the production of sulphite pulp) a suitable type is the resin OSTION-SL (L-33). The treatment removes colour-producing and biochemically resistant substances which is of importance for the reuse of treated water in the production process. This resin can be also used for sulphate pulp mill effluents treatment after biological pretreatment as in the case of sulphate pulp mill effluents and bleaching process effluents. (Hancuff-Texas)
W70-10338

SIGNIFICANCE AND LIMITS OF THE BUCHNER-FUNNEL-FILTRATION-TEST (BFFT),
E. Zingler.
Fifth International Conference on Water Pollution Research, San Francisco, July 26-August 1, 1970. Preprint, Paper II-31, 8 p, July-August 1970. 5 fig, 6 ref.

Descriptors: *Filter, *Vacuum drying, *Test procedure, *Limiting factor, *Laboratory tests, Evaluation, Sludge, Sludge treatment, Waste water treatment.
Identifiers: *Buchner funnel, Vacuum filtration.

Assessments of properties and filterability of sewage sludges are gained through laboratory tests. However, it is well known that there is a risk when the lab. testing results are practically applied. This risk must be attributed to: (a) a lack of standard methods, (b) insufficient attention given to factors of technical procedure. In an account of a research project on sludge dewatering the results of Buchner-Funnel-Filtration-Tests (BFFT) are presented for subpressure conditions. Exemplified by the Buchner-Funnel some causes must be pointed out which may lead to divergencies in the results arrived at by various researchers: (a) Considerable divergencies emerge if different filterpapers are used in filtering untreated sludges. (b) So far no attention has been given to the storage capacity of the perforated plates of the Buchner-Funnels. Depending on construction and diameter 2 to 14 cu cm of sludge water are retained in the slotted plates before the filtrate flows into the measuring cylinder. (c) The quality of comparable parameters is decisively codetermined by test arrangement and implementation. (d) A further instability factor for comparable parameters results from the recommendation to build up slowly the required pressure. (Hancuff-Texas)
W70-10339

QUALITY PREDICTIONS IN A POLLUTED ESTUARY,
Clyde River Purification Board, Glasgow (Scotland).
D. W. Mackay, and J. I. Waddington.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper III-7, 6 p, July-August 1970. 4 fig, 4 ref.

Descriptors: *Estuaries, *Water pollution control, *Water quality, Retention, *Sewage disposal, Sewage treatment, Dissolved oxygen, Flows, Tides, Rivers.
Identifiers: Marine disposal.

Methods of measuring the degree of organic pollution in an estuary and predicting the effects of changes in the polluting load are described. A reduction in the load from one source produced a considerable improvement along the length of estuary considered, the extent of which was in accordance with that predicted. A relatively simple approach to the problem of estuary management has produced results useful for dealing with such problems as (1) the acceptability of new polluting discharges, (2) the priorities to be established from improvement of existing discharges, (3) predicting the effects of large scale water abstraction from one of the main feeder rivers and (4) predicting the temperature rises which might be expected from the siting of thermal power stations at various locations. No claim is made that a full understanding of the processes involved has been achieved, for example current work is showing that the relationship between dissolved oxygen and freshwater flow derived during a period of normal rainfall pattern does not hold good under conditions of exceptionally prolonged drought. As the investigation continues with more refined techniques, it should be possible to discard initial assumptions and render this useful and relatively economic approach adequate for the task of aiding the management of a rapidly changing estuary system. (Hancuff-Texas)
W70-10340

STUDIES ON PARAMETERS AFFECTING SLUDGE DEWATERING IN PRESSURE FILTERS,
Emschergenossenschaft, Essen (West Germany).
H. Graefen, and H. J. Donges.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-30, 10 p, July-August 1970. 12 fig, 5 ref.

Descriptors: *Dewatering, *Filters, *Sludge, Pressure, *Sludge treatment, Sewage treatment, Filtration, Design, Efficiencies, Fly ash, Activated sludge, Waste water treatment.
Identifiers: Pressure filters, Filterability.

Pressure filters are more and more used for the dewatering of waste water sludges. In general they enable dewatering to a degree such as to obtain firm and transportable sludge cakes with solid contents of more than 50%. At the same time, the sludge volume is reduced to less than 20% of the initial sludge volume. Due to the high degree of dewatering, the caloric value of these sludge cakes is usually above 1500 kcal/kg so that they will burn on their own without additional fuel. The properties of the sludge, especially its filtrability, form the decisive parameter for the efficiency of the pressure filters. To characterize the properties of the sludge, parameters such as the solids content, the structure and the size distribution of the solids, the index of the activated sludge and the organic matter are generally used. These and possibly other characteristics can sufficiently describe various chemical and physical properties of the sludge. In general, domestic and industrial sewage sludges cannot be dewatered in pressure filters without previous conditioning. This applies especially to activated sludge. Improvements of the filtrability of sludges can be attained by filter aids such as iron chloride, iron sulphate and lime, or by the addition of polymers or solid matter, especially fly ash. Much more effective for improving the filtrability of activated sludge is thermal conditioning. (Hancuff-Texas)
W70-10341

VIRUS REMOVAL BY ADSORPTION IN WASTE WATER TREATMENT PROCESSES,
Maine Univ., Orono. Dept. of Civil Engineering.
Otis J. Sproul, Murray Warner, Leo R. La Rocholle, and Dirk R. Brunner.
Fourth International Conference on Water Pollution Research, Prague, Czech., September 2-6, 1968. Preprint, Paper 13, 7 p.

Descriptors: *Viruses, *Activated carbon, *Adsorption, *Efficiencies, *Phosphates, *Chemical precipitation.
Identifiers: *Virus removal.

Studies on the removal of viruses from waste water by activated carbon adsorption and calcium and aluminum phosphate precipitation are described. Viruses employed in this work were the T2 bacteriophage and Type 1 poliovirus (Sabin). They were suspended in domestic secondary treatment plant (trickling filter and activated sludge) effluent or saline water for all runs. Virus removal by activated carbon adsorption with an initial T2 virus concentration of 1,000,000 plaque forming units (Pfu) per ml resulted in maximum removals of 32, 9, and 7 percent at column hydraulic loadings of 40.8, 122, and 326 l/min/sq m, respectively. It was observed during the poliovirus runs that after 25 l input, virus concentrations in the effluent exceeded those of the influent to the columns indicating a reversible process. Precipitation by calcium phosphate resulted in poliovirus removals exceeding 90%, for an initial phosphate concentration of 85 mg/l and 182 mg/l calcium hydroxide. T2 removals by aluminum phosphate precipitation exceeded 98% and reached 99.9% for various initial phosphate concentrations and alum dosages. It was concluded that virus removal by activated carbon adsorption is not a dependable process but that removals by phosphate precipitation would appear both reliable and a valuable additional benefit in the removal of phosphate. (Sorber-Texas)
W70-10342

PRESSURE FILTRATION OF SECONDARY TREATMENT PLANT EFFLUENT,
Robert A. Taft Water Research Center, Cincinnati, Ohio. Advanced Waste Treatment Research Lab.
Edward L. Berg, and Carl A. Brunner.
Water and Wastes Engineering, Vol 6, No 10, p 54-58, October 1969. 5 fig, 6 tab.

Descriptors: *Effluents, *Pilot plants, *Filtration, *Costs, *Waste water treatment, *Tertiary treatment, Flocculation, Operating costs.

Identifiers: *Single medium filtration, *Dual media filtration, Anthracite coal, Polyelectrolytes, Alum.

A field study using a commercial pressure filter to clarify secondary treatment plant effluent is described. Two different filter beds were evaluated: a single-medium filter consisting of 20 inches anthracite coal (effective size 0.75 mm) and a dual-media filter consisting of 6 inches sand (effective size 0.45 mm) and 14 inches anthracite coal. Filtration rates were either 5 or 10 gpm/sq ft and filter performance was determined by measurement of filter headloss, influent suspended solids and effluent turbidity. Four different polyelectrolytes were investigated in conjunction with varied alum dosages. Results indicated that cationic polyelectrolytes were more effective in preventing floc break through than were the nonionic or anionic polyelectrolytes. For the single medium filter using dosages of 2.16 mg/l polyelectrolytes and 14.5 mg/l alum at a filtration rate of 10 gpm/sq ft. total organic carbon (TOC) removal was 50% and phosphate removal was 17%. Slightly better TOC removal and significantly less phosphorus removal was observed in the dual media filter under similar conditions. Estimates for a 1 mgd capacity plant indicated a total cost of 6.7 cents per 1000 gallons for this type treatment. (Sorber-Texas)
W70-10343

PILOT PLANT STUDIES OF EFFLUENT RECLAMATION,
Eimco Corp., Salt Lake City, Utah.
J. D. Phillips, and G. L. Shell.
Water and Wastes Engineering, Vol 6, No 11, p 38-41, November 1969. 4 fig, 5 tab, 7 ref.

Descriptors: *Effluent, *Reclamation, *Pilot plants, *Filtration, Coagulation, Activated carbon, Phosphorus, Biochemical oxygen demand, Alkylbenzene sulfonates, Irrigation water, Cooling water, Water reuse.
Identifiers: *Dual-media filtration, Chemical treatment, Suspended solids.

A two-phase study to determine the best processes to be used for reclaiming sewage treatment plant effluent for use as irrigation water and inexpensive cooling tower make-up water is discussed. The first phase dealt with the removal of larger suspended solids to prevent fouling of irrigation sprinklers. A dual-media filter employing anthracite coal and sand was investigated. It was found that an 8 foot deep filter consisting of 50% anthracite was most effective in removing the suspended solids. Results indicated that filter runs of up to 50 hours could be achieved at filtration rates of between 10 and 20 gpm/sq ft. Suspended solids removal varied between 24 and 35%. The second phase involved producing a good quality effluent to be used as cooling tower make—UP WATER. Processes selected were chemical coagulation, dual-media filtration, and activated carbon adsorption. Coagulation with lime at 325 mg/l or alum at 175 mg/l resulted in 74-85% removal of BOD5; 70-80% removal of suspended solids; and 91-95% removal phosphorus. A 50% anthricite 4-ft-deep dual media filter produced further reductions in BOD5, suspended solids and phosphorus of 25%, 60%, and 50%, respectively. Carbon adsorption results in indicated additional removals of 33% for BOD5; 80% for COD; 25% for suspended solids; 50% for phosphorus; and 97% for ABS. (Sorber-Texas)
W70-10344

NUCLEIC ACID AS A COMPONENT OF MUCILAGE IN ACTIVATED SLUDGE,
Kurita Central Labs., Yokohama (Japan).
Shozo Nishikawa, and Mitsuo Kuriyama.
Water Research, Vol 2, No 7, p 811-812, July 1968. 2 tab, 5 ref.

Descriptors: *Activated sludge, *Biochemistry, *Enzymes, Metals.
Identifiers: *Nucleic acid, *Deoxyribonuclic acid (DNA), *Ribonucleic acid (RNA), Composition.

It is reported that high amounts of DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) are contained in mucliage in activated sludge from sewage. The DNA and RNA are folded in the sludge floc and are protected with metal ions. The method of extraction of this DNA and RNA employs EDTA and 95% ethanol with sodium chloride. Fractionation and quantification followed for DNA and RNA of activated sludge and Escherichia coli. From E. coli only 1.8 percent of its RNA and a trace of DNA was extracted while as much as 40 percent of the DNA and RNA in the activated sludge was obtained. It was concluded that from activated sludge, (1) mucliage containing nucleic acid can be obtained without breaking down the living cells by extracting it with EDTA solution; (2) polymerized nucleic acid is folded in the floc as an insoluble form together with protein; (3) this nucleic acid is protected by metal ions; and (4) nucleo-protein released by autolyzis from microbial cells in the activated sludge is accumulated and is prevented from enyzmatic depolymerization. (Sorber-Texas)
W70-10345

THE DALLAS PHILOSOPHY-AN APPROACH TO WASTE WATER RECLAMATION,
Dallas, Tex.
Henry T. Graeser.
Water and Wastes Engineering, Vol 6, No 9, p 58-61, September 1969.

Descriptors: *Water reuse, *Research facilities, Water quality, Pilot plants, Political aspects, Public health.
Identifiers: *Water hygiene.

The problems, advances and necessity of increased waste water reuse are explored from a philosophical point of view. It is pointed out that waste water reuse is an actuality in many instances today and water requirements for the future make this practice of continuing increasing importance. Figures are quoted indicating that federal funds allocated for research in water hygiene in fiscal year amount to a mere 1 percent of the total for environmental pollution research. An example of what Dallas, Texas is doing or is planning to do at its water Reclamation Research Center and Laboratory is presented. Some of the problems of water reuse including public acceptance, costs, research, and interagency cooperation are explored. (Sorber-Texas)
W70-10346

WASTE WATER TREATMENT: THE TIDE IS TURNING.
Robert W. Holcomb.
Science, Vol 169, No 3944, p 457-459, 31 July 1970.

Descriptors: *Waste water treatment, Pollution abatement, Water pollution control, Sewage treatment, Tertiary treatment, Chemical precipitation, Activated carbon, Electrodialysis, Reverse osmosis, Filtration.
Identifiers: Microscreens.

A general discussion of the current state of sewerage and sewage treatment is presented. Successes in pollution abatement and properties of sewage are mentioned. Primary and secondary sewage treatment systems are described and performance data in terms of solids and Biochemical Oxygen Demand removal are given. New processes and systems of waste treatment are discussed with respect to BOD, solids, nitrogen and phosphorous removal. Comparisons are made between the performance and costs of new and old systems and processes. Specific developments and processes discussed are: the use of pure oxygen in the activated sludge process, the precipitation of phosphate with lime, multimedia filtration, microscreening, carbon adsorption of refractory organic compounds, ion-exchange units, electrodialysis, reverse osmosis. The problem of final sludge disposal is mentioned along with current solutions and desirable developments of the future. The need for a broad-based research and development program to solve existing problems and to explore new areas is elucidated. (Hewett-Rutgers)
W70-10350

SOME ECONOMIC ASPECTS OF WATER REUSE IN CZECHOSLOVAKIA,
International Water Pollution Research Conference (5th).
V. Reinhardt.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-31. 6 p, 2 tab, 12 ref.

Descriptors: *Water utilization, *Water re-use, Recirculated water, Reclaimed water, Water demand.
Identifiers: Effluent charges, Czechoslovakia.

Water re-use is a significant factor in water utilization. For water re-use via water courses, the relation between the treatment costs of discharged waste waters and damage caused by the polluted water is discussed. Statistical data are given showing a relatively high degree of recirculation of water in Czechoslovakian industry. Degree of circulation is a general index of level of water management, but is not a goal per se as there are other important factors to consider. Data are also given showing water use, and unit costs including some data on taxes for releasing untreated waste and municipal sewage charges. Industry has not yet used sewage effluent in Czechoslovakia, but the author outlines situations in which this would be very desirable. (Whipple-Rutgers)
W70-10372

THE APPLICATION OF A LINEAR PROGRAMME MODEL TO WATER CONSERVATION AND EFFLUENT MANAGEMENT AT MODDERFONTEIN FACTORY,
African Explosives and Chemical Industries Ltd., Johannesburg (South Africa); and National Inst. for Water Research, Pretoria (South Africa).
N. A. Lever, A. T. Alexander, R. J. Buttery, B. Moffat, and M. R. Henzen.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-30. 9 p, 2 fig, 3 ref.

Descriptors: *Linear programme, *Water conservation, Management, *Effluents, *Industrial wastes, *Mathematical models, Water supply, Water reuse, Constraints, Stochastic processes, Costs.

The demand for water in South Africa is briefly reviewed together with the need to purify effluents. Modderfontein Factory faces the problem of conserving water while at the same time satisfying tentative standards laid down by the Department of Water Affairs. There are a number of sources of second grade water available which could be used to supplement the limited supply of first grade potable water. A mathematical model is described which enables the effect of the use of various grades of water to be rapidly assessed, using the Company's IBM computer. The programme is run through weekly and the use of an optimum mix has enabled the factory to save 85 million imperial gallons per year of potable water giving rise to a new savings of R12,000 per year. It is concluded that mathematical modeling has wide application under similar conditions. (Hancuff-Texas)
W70-10374

THERMONALYTICAL CONTROL OF THE SLUDGE STABILIZATION PHENOMENA,
Research Inst. for Water Resources Development, Budapest (Hungary).
P. Benedek, P. Farkas, and P. Litherathy.
Fifth International Water Pollution Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper HA-8. 7 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Sludge, *Stabilization, *Digestion, Operations, *Design control, Anaerobic digestion, Biological treatment, Waste water treatment, Sewage treatment, Water pollution control.
Identifiers: *Thermoanalytic method.

The purpose of sludge stabilization is to decrease organic material subject to decomposition, as well as fixed or stored water in different forms, or rather to release the latter with a view to facilitation dewatering. Variation of organic material contents could be followed by measuring volatile solids. However, the former comprises both the weight loss due to Thermal decomposition of inorganics and the effect of evaporation of fixed water in the sludge. Presented is a reliable method for the practicing engineer with which he may follow variations of organic material and fixed water contents of sludge for the design operation and control of biological sludge stabilization systems. The extent of stabilization may be determined reliably with the ignition loss measurement applied in routine laboratories with the modification that first the ignition should be carried out in nitrogen and then the previously obtained carbon residue is ignited in oxygen. The sludge stabilization may be considered to be terminated when with increasing stabilization time the carbon determined by means of the above procedure does not further decrease. (Hancuff-Texas)
W70-10375

AN INTEGRATED BIOLOGICAL-CHEMICAL PROCESS FOR MUNICIPAL WASTE WATER TREATMENT,
California Univ., Berkeley. Sanitary Engineering Research Lab.
M. J. Humenick, and W. J. Kaufman.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-19. 18 p, 4 fig, 6 tab, 24 ref.

Descriptors: *Waste water treatment, *Biological treatment, Chemical precipitation, *Performance, Sewage treatment, Kinetics, Aeration, Activated sludge, Mathematical models, Efficiency, Phosphorus.
Identifiers: *Chemical treatment.

An integrated biological-chemical waste water treatment pilot plant was operated over a period of 8 months at organic loadings appreciably exceeding those normally employed in municipal biological waste treatment systems. The system involved two stages: biological stage followed by a precipitation flocculation stage with inorganic chemical solids recycled to the first stage to achieve continuous control over the separability of the biologically active solids. The results of the investigation are as follows: (1) removals of BOD were at an excess of 90% and COD an excess of 80%, at BOD loadings of 400 to 500 lbs per day per 1000 cubic foot variation. Under these conditions the residence time of the aeration basin may be reduced one hour and good performance may be expected with as little as 20 minutes of variation. Sludge volume indicies of over 100 were achieved at suspended solids concentration in exceeding 9,000 mg/l. Phosphorus removal of at least 95% was demonstrated with both lime and alum additions to the second stages of precipitation flocculation unit. The second stage clarifier was operated as a sluged blanket unit with the overall suspended solids removal generally exceeding 95%. The effluent was generally lower than 20 JTU and less than 10 for extended periods. (Hancuff-Texas)
W70-10376

TECHNIQUE OF EVALUATION OF SYSTEM PARAMETERS RELATING SOLIDS ACCUMULATION IN OXIDATION DITCHES PROCESS,
N. Chandhuri.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-10. 7 p, 5 fig, 3 tab, 13 ref.

Descriptors: *Evaluation, Performance, Kinetics, Mathematical models, Sludge, Waste water treatment, *Sewage treatment, *Biological treatment.
Identifiers: *Oxidation ditch, Solids wasting, Solids accumulation, Suspended solids.

Biologically, the oxidation ditch process is an extended sludge aeration modification of the activated sludge process. Like extended sludge aeration plants, oxidation ditches are without controlled sludge wasting, because it was believed that daily accumulation of sludge solids in the system would be negligible as the period of aeration was extended. Subsequent investigations disproved this belief and demonstrated that non-degradable fractions of microbial mass accumulated in the system. For better operational control of extended aeration plants a method should be evolved to predict accumulation of sludge solids. The paper presents a technique to evaluate system parameters relating to solids accumulation. A study was conducted on an oxidation ditch as a reactor vessel which was operated as a batch feed system using slow feeding a full days loading of nutritionally balanced glucose solution as a substrate. The oxidation ditch was operated at a wide range of volumetric process loadings of 20 to 100 lbs of COD per day per thousand cubic feet ditch volume. The system operated under conditions of no solids wasting showed an accumulation of sludge solids in amount equal to 18% by weight of the COD utilized. (Hancuff-Texas)
W70-10377

NITROGEN-PHOSPHATE RELATIONSHIPS AND REMOVALS OBTAINED BY TREATMENT PROCESSES AT THE HYPERION TREATMENT PLANT,
California State Dept. of Public Works, Los Angeles.
R. D. Bargman, J. M. Betz, and W. F. Garber.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-14. 17 p, 7 fig, 5 tab, 13 ref.

Descriptors: *Nitrogen, *Phosphorus, *Sewage treatment, *Nitrification, *Chemical precipitation, Nutrients, Waste water treatment, Efficiencies, Operations, Metals.
Identifiers: *Hyperion.

The Hyperion treatment plant of the City of Los Angeles received an average waste water flow of 340 MGD during 1969. In this daily flow were approximately 86,000 lbs of phosphate, 51,000 lbs of ammonia, and 102,000 lbs of organic nitrogen. Because phosphate removal as well as overall affluent quality requirements are becoming more severe, the secondary treatment design parameters may well have to be considered in terms of findings of this report. A removal of 95% of the soluble phosphate from the flow of about 50 MGD over a six month period was observed after minor process modification was made. The secondary effluent phosphate as phosphorus had been decreased from about 19 mg/l to less than 0.5, wasting the waste activated sludge directly to the sludge treatment facilities with the digested sludge resulted in this increased phosphate removal. To examine this phenomenon a little more fully a series of laboratory tests were made using two-meter beakers. The results showed that as air rates increase from 4.7 to 18.5 cubic foot per gallon quicker precipitation of the phosphate was observed in addition to swifter nitrification and a rapid rise of the pH to about 7.6 followed by a steady increase to about 7.9 in 7 to 9 hours. (Hancuff-Texas)
W70-10378

HYDRAULIC FIELD TESTS ON A SETTLING BASIN,
Research Inst. for Water Resources Development, Budapest (Hungary).
L. Muszkalay.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-18. 6 p, 5 fig, 3 ref.

Descriptors: *Settling basin, *Hydraulics, Testing, Statistics, *Retention, Design, Efficiency, Time, Distribution, Statistic processes, *Settling basins.

The hydraulic behavior of settling basins equipped with a row of weirs as a distribution system has been determined for the time of residence, based on observed discharges. The function is analogous to the flow-thru hydrograph determined by the continuous ploting of a tracer material. Mathematically and physically defined hydraulic deficiencies, the standard deviation of time of residence and distribution of flow velocities can be determined with the help of this function. Below the design discharge of 50LPS hydraulic efficiencies were found to deteriorate rapidly, owing mainly to the non-uniform design of the weirs. In the range of 40 to 75 LPS the design range hydraulic efficiencies were found to remain fairly constant accompanied by small scatter of the lines of residence. Within the design range the basin is capable of accommodating changes in discharge. Conditions of settling are rather low. Efficiency can be raised by improving the weirs. (Hancuff-Texas)
W70-10379

OBSERVATION OF THE VIRUS BINDING CAPACITY OF SLUDGE,
Royal Veterinary and Agriculture Coll., Copenhagen (Denmark).
E. Lund.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-24. 5 p, 2 tab, 5 ref.

Descriptors: *Viruses, *Sludge, *Digestion, Activated sludge, Sewage treatment, Waste water treatment, Microorganisms, Isolation.
Identifiers: *Binding capacity.

The virus binding and inactivating capacity of activated sludge treatment is reported to have been studied in experiments where a known quantity of virus has been added to sludge samples in a pilot plant system or in a sewage plant. Such experiments have also been carried out in order to get an estimate from a quantitative point of view and have furnished much useful information. Artifically virus contaminated systems and the methods applied to recover virus from these may not be relevant however in connection with the naturally occurring viruses. These may be present in the sewage in a different way. A number of observations regarding the virus binding capacity in sludge are made. A comparison is made between virus isolation from sludge samples and influent and effluent swab samples. The effluents samples contained, when virus is demonstrated, the same types of Coxsackie B strains as the effluents. But ECHO strains are demonstrated more frequently in the effluent than in the raw sewage influent. The Adenovirus strains were found only in the influent samples. When comparing the recovery of virus from samples by means of 2 hours against 24 hour absorption periods there was no higher percentage of virus positive cell cultures. A fractionation of sewage samples by means of centrifugation is also discussed. (Hancuff-Texas)
W70-10380

THE FULL-SCALE RECLAMATION OF PURIFIED SEWAGE EFFLUENT FOR THE AUGMENTATION OF THE DOMESTIC SUPPLIES OF THE CITY OF WINDHOEK,
National Inst. for Water Research, Pretoria (South Africa).
L. R. J. Van Vuuren, M. R. Henzen, G. J. Stander, and A. J. Clayton.
Fifth International Water Pollution Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-32. 9 p, 5 fig, 4 tab, 8 ref.

Descriptors: *Sewage treatment, *Waste water treatment, *Tertiary treatment, *Water reuse, *Water quality, Water supply, Algae, Activated carbon, Adsorption, Filtration, Chlorination, Chemical precipitation, Flocculation, Flotation.
Identifiers: Windhoek, South Africa.

In early September 1968, a critical situation in water supply and demand developed which necessitated the expeditous conditioning of a full-scale water renovation plant. The reclaimable sewage effluent is derived from a conventional sewage treatment plant comprised of primary sedimentation by filtration, secondary sedimentation followed by further biological purification in 9 maturation ponds in series. Total hydraulic retention time is 14 days. The reclamation plant constitutes an integral part of the existing water treatment works and is comprised of recarbonation, algae flotation, foam fractionation, chemical flocculation, break point chlorination, clarification, sand filtration and activated carbon. The reclaimed water after carbon absorption is mixed with purified raw water and the clear water supply. The add mixed strains are then post-chlorinated to a free residual of 0.2 ppm and then pumped to the city's service reservoirs. The total cost for the production of reclaimed water including fixed capitol, chemical and running costs, amount to 11.9 cu pm, while the average costs for purified dam water are 10.7 cu pm. The cost figure for carbon treatment is based on a single use of the carbon medium without regeneration resulting in a high cost. If regeneration facilities are provided it is estimated that the total cost for reclaimed water will be 9.53 cu pm. (Hancuff-Texas)
W70-10381

CONTRIBUTION TO THE PROBLEM OF BIOFLOCCULATION IN THE ACTIVATED SLUDGE PROCESS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Zurich (Switzerland).
G. Peter, and K. Wuhrmann.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-1. 9 p, 5 fig, 1 tab, 9 ref.

Descriptors: *Sewage treatment, *Activated sludge, *Flocculation, Waste water treatment, Microbiology, Microorganisms, Colloids, Stablization, Particle size.
Identifiers: *Bioflocculation, Polyelectroytes, Destabilization.

Investigations with 16 bacterial strains, isolated from activated sludge, revealed that the phenomena involved in the process of flocculation can be best understood under the assumption of bacterial cells representing protected dispersoids. Stability of aqueous suspensions of bacteria is therefore not or not essentially a function of double layer repulsion. Bridging by chain (DEAE, Dextran, Sulfate) or particulate (Bentonite) polymers is the predominant mechanism for the flocc formation in bacterial suspensions, and has already been proposed by earlier authors. Various factors presumably interfering with the absorption of polymeric flocculation agents on the cell surfaces were studied (Type and growth phase of organisms, pH, electrolyte concentration, partical size, type of polymer, etc.). There is evidence that humic acid polymers are as effective as flocculation agents in activated sludge. It is assumed that in practical plant operations the formation and polymerization of humic acids may represent determining parameters for the clarification of the effluents. (Hancuff-Texas)
W70-10382

AN ENZYMATIC TECHNIQUE TO DETECT SURPLUS PHOSPHORUS UPTAKE BY ACTIVATED SLUDGE,
Texas Univ., Austin. Environmental Health Engineering Research Lab.
E. G. Fruh, W. E. Morgan, H. G. Moore, Jr., R. B. Higgins, and M. L. Shahan.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-2. 14 p, 12 fig, 6 tab, 14 ref.

Descriptors: *Phosphorus, *Enzymes, *Activated sludge, Measurements, Test procedures, Waste water treatment, *Sewage treatment, Metabolism, Kinetics, Chemical precipitation, Sorption.

An alkaline phosphatase bioassay technique procedure is evaluated for use in detecting surplus phosphorus uptake by activated sludge cultures. This evaluation is based on both batch and continuous flow bench scale units. All of the experiments conducted indicated a general relationship existing between alkaline phosphatase activity and surplus phosphorus. High enzymatic activities and low cellular phosphate are associated with low influent phosphorus concentrations; low enzymatic activities and high cellular phosphorus are associated with intermediate and high influent phosphorus concentration. However, no quantitive relationship was found during the experiments relating enzymatic activities to cellular phosphorus. The long term continuous unit indicated a biological selection process was always present. Bacteria with phosphorus requirements suited to the influent phosphorus concentration predominated. This normal continuous selection process in mixed bacterial cultures increases the difficulties encountered in evaluating metabolic relationships and perhaps may have masked any quantitative result that could or did exist in these experiments. These experiments did not indicate a practical quantitative relationship between alkalinity and phosphotase and cellular phosphorus for evaluating surplus uptake of phosphorus for mixed bacterial cultures, i.e. activated sludge. (Hancuff-Texas)
W70-10383

EFFECT OF FOREIGN COMPONENTS ON THE PRECIPITATION OF PHOSPHATE BY ALUMINUM,
Rutgers - The State Univ., New Brunswick, N.J.
Wen Lin Yuan, and Pa Ho Hsu.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-16. 12 p, 8 tab, 13 ref.

Descriptors: *Chemical precipitation, *Phosphate, *Aluminum, Effects, Fluoride, Kaolinite, Montmorillonite, Waste water treatment, *Coagulation.
Identifiers: Polymers.

Aluminum salts can be used as coagulants to precipitate phosphates from waste water. This report presents evidence indicating that many other components such as sulphate montmorillite and kaolinite can react with hydroxyaluminum polymer in a similar manner as phosphate ion. In the presence of sulphate precipitation is greatly improved in all samples of p/Al ration equal to 0.3 or below. Thus aluminum dosage can be less critically controlled. In the presence of fluoride the effective phosphate precipitation is achieved only when the amount of fluoride equals the residual positive charge on the hydroxyaluminum polymers. Phosphate precipitation is also proved in the presence of montmorillonite in samples of p/Al more ratio equal 0.3 or below, but considerable amounts of phosphate remain in the solution in most samples. pH of phosphate precipitation varies with the nature and concentration of formed components present. Consequently pH adjustment is not a reliable criterion for controlling phosphate precipitation. The worst effects indicated by foreign components are attributed to two mechanisms of opposing effects: (1) foreign components tend to neutralize the residual positive charge on the polymers and thus precipate both phosphate and aluminum together and (2) these components can compete against phosphate in reacting with hydroxyaluminum polymers thereby reducing the effect of the phosphate precipitation. (Hancuff-Texas)
W70-10384

MICROBIOLOGICAL ASPECTS OF SEWAGE TREATMENT,
Institut Pasteur, Paris (France).
H. Leclerc, A. Perchet, C. Savage, S. Andrieu, and R. Nguematcha.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-23. 8 p, 6 tab, 7 ref.

Descriptors: *Microbiology, *Microorganisms, *Sewage treatment, Waste water treatment, *Pathenogenic bacteria, Salmonella, Mycobacterium, Yeasts.
Identifiers: Parasites, Saprophytic organisms, Hydromycetes.

Up to the present the dangers involved in the handling of numerous microbial pathogenic species, has not seemed to be of great concern to those responsible for treatment of sewage. This study assesses the importance of the risk of infection by defining different kinds of organisms obtained in sewage and by studying their fate during the treatment most commonly applied to liquid sewage or sewage sludges. The samples studied were taken from 18 biological sewage works distributed throughout the whole area of French territory. An impressive variety of pathogenic microorganisms were found to be present in sewage. As a rule these organisms are climinated and concentrated in the sludge. This is true in the case of Salmonella, and for most parasites and fungi. On the other hand Mycobacteria as a whole are found with equal frequency in sewage effluent and in the sludge. Anaerobic digestion, although eliminating between 90 and 99.9% of the total number of entero-bacteria, allow the Salmonella to survive in 75% of the cases; anaerobic digestion must be followed by natural drying in open air before they disappear entirely. Recommendations are presented as to microbiological testing as well as the microorganisms which should be investigated during an inspection. (Hancuff-Texas)
W70-10385

WATER RE-USE IN THE RUHR VALLEY WITH PARTICULAR REFERENCE TO 1959 DROUGHT PERIOD,
Ruhrverband, Essen (West Germany).
H. W. Koenig, G. Rincke, and K. R. Imhoff.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-4. 8 p, 5 fig, 1 tab, 7 ref.

Descriptors: *Water re-use, *Water supply, *Water quality, Standards, *Domestic water, Tertiary treatment, Waste water treatment, Water treatment, Groundwater recharge, Droughts, Runoff, Rainfall.
Identifiers: Ruhr Valley (Germany), Bigge Reservoir, Lippe River, Ruhr River.

Two million people live in the Ruhr catchment in which considerable industrilization has developed. Prior to discharge waste water is mechanically and biologically treated. Four river impoundments provide for tertiary treatment. In summer, river flow is augmented by reservoir discharge. Water works abstracted the mixed river water and obtain drinking water by groundwater recharge. The system described insures a water in adequate quanties and acceptable drinking quality is available at all times to the 5 million inhabitants and various industries. In 1929, the reuse of 300% was experienced without detrimental effects. In December 1959 hard detergents and ammonia could not be sufficiently decomposed at 86% reuse. In October of 1959 65% reuse still gave acceptable conditions. These figures were related to a water consumption of 150 meters per capata per day. After completion of the Bigge Reservoir the reuse factor would not exceed a maximum of 22%, if a recurrence of the 1959 drought were to occur. No difficulties have resulted from this reuse. (Hancuff-Texas)
W70-10386

THE SEASONAL ACCUMULATION OF SOLIDS IN PERCOLATING FILTERS AND ATTEMPTED CONTROL AT LOW FREQUENCY DOSING,
Aston Univ., Birmingham (England).
H. A. Hawkes, and M. R. N. Shepherd.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-11, 8 p, 5 fig, 1 tab, 10 ref.

Descriptors: *Trickling filter, Control, Seasonal, *Dosing frequency, Sewer treatment, Waste water treatment, Ecology, Efficiency, Films.
Identifiers: *Suspended solids, *Solids accumulation.

In trickling filters treating domestic sewage a regular accumulation of solids occurred each winter, this accumulation being greater the colder the winter. Below 10 deg a few degrees difference in the average winter bed temperature results in considerable differences in theamount of solids present. The subsequent unloading of the filter is greatly accelerated by the active raising of the macro-inter-bed fauna at times of rising temperature. A test with low frequency dosing limited the winter accumulation of solids in the surface layer of the filter and also reduced significantly the population of fly larva, thus reducing the potential fly nuisance. The optimum frequency for any filter is determined by the hydraulic conditions of retention time and by the need to maintain the desirable ecological balance. (Hancuff-Texas)
W70-10387

NITRIFICATION IN TREATMENT PLANTS AND NAUTRAL WATERS: SOME IMPLICATIONS OF THE THEORETICAL MODELS,
Water Pollution Research Lab., Stevenage (England).
A. L. Downing, and G. Knowles.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-8. 8 p, 4 fig, 1 tab, 6 ref.

Descriptors: *Nitrification, *Sewage treatment, *Amonia, *Activated sludge, Nitrate, Kinetics, Nitrite, *Mathematical models, Waste water treatment, Temperature, Dissolved oxygen, Rivers, Estuaries.
Identifiers: Natural waters, Nitrobactor, Nitrosimonas.

With increasing expenditures being devoted to pollution control in many counties it is important that the self-purification process governing the fate of ammonia in natural waters be throughly understood. Examination of the influences of nitrification, in particular natural waters, to determine which of the possible kinetic models best represent the real situation. If the basic concept of the theory put forward to account for the behavior of nitrifying activated sludge plants is that the population of nitrifying bacteria in the sludge will alter according to the difference between the rate of growth of nitrifying organisms in the parts of the plant in which the concentration of dissolved oxygen is adequate and their rate of removal as a result of withdrawl of surplus sludge and loss of sludge particles in the effluent. These two rates are related to the operation conditions. In a river, it is implied that a partically nitrified effluent will have a more severe effect on the oxygen resources than if no nitrification were achieved. Different interpretations of kinetics of nitrification in a relation to estuaries can conveniently be examined in terms of simple steady state model which the estuary is assumed to consist of a series of uniformly mixed segments. If the bacterial growth kinetics govern the situation the oxygen resources of the system may be more severely taxed by a process of nitrification in partially nitrified sewage influents or discharge. (Hancuff-Texas)
W70-10388

THE USE OF PLASTIC MATERIAL AS A MEDIUM FOR TRICKLING FILTERS TREATING DOMESTIC SEWAGE,
L. Audoin, J. P. Barabe, G. Brebion, and B. Huriet.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-16. 10 p, 10 fig, 1 tab, 7 ref.

Descriptors: *Trickling filters, *Sewage treatment, *Plastics, Materials, *Domestic wastes, Waste water treatment, Depth, Hydraulics, Efficiencies, Organic loading, Pilot plants, Biochemical oxygen demand.

The removal of organic load in two units of 3 pilot trickling filters filled with 'Cloisonyle' tubes was studied at different rates with either identical cross sections and different depths or identical volume and depths. The performance was as high as 9 kilograms of BOD removed per cubic meter of filter per day without recirculation. Experiments have shown that for settled sewage depth beyond 3 meters has practically no effect on performance and removal efficiency of the organic load. This conclusion is based on studies with constant organic loads and with constant superficial hydraulic loadings. It concluded that large removal of organic loads can be obtained with low pumping costs (100 to 150 watt hours per kilogram of BOD removed), since the high efficiencies indicated up to 9 kilograms BOD per meter cube per day did not require recirculation of the effluent. This removal of 9 kilograms BOD pcm corresponds to a maximum applied load of 20 kilograms of BOD pcm/per day. The superficial hydraulic loading utilized in this study varied from 0.54 to 5 cubic meters per square meter per hour. (Hancuff-Texas)
W70-10389

B.O.D. REMOVAL AND NITRIFICATION OF ANAEROBIC EFFLUENT BY ACTIVATED SLUDGE,
Technion - Israel Inst. of Tech., Haifa.
A. Melamed, C. Saliternik, and A. M. Wacks.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-18. 8 p, 6 fig, 11 ref.

Descriptors: *Nitrification, *Anaerobic conditions, *Activated sludge, *Denitrification, Kinetics, Mathematical models, Oxidation, Nitrite, Biological treatment, *Biochemical oxygen demand.

Due to the increasing significance of nitrogen remval in waste treatment, research was carried out on nitrification and denitrification as a powerful tool for nitrogen removal. It is suggested that the effluent nitrified in the aerobic unit may be recycled through the anaerobic one, thereby achieving the removal of nitrogen. In this report performance of the aerobic part of the system, namely the activated sludge process, was investigated. Kinetics of BOD removal and of nitrification were studied independently. A model (Michaelis Menten equation) based on enzyme kinetics and mixed cultures is used. For BOD the removal rate was 1.5/days. The half removal rate constant was 21 mg/l giving correlation coefficient of 0.92. For nitrification, that is ammonia to nitrate and nitrite to nitrate, the respective values were 2.49/days and 0.37 mg/l ammonia as nitrogen and 0.25 mg/l nitrite as nitrogen. The respective correlation coefficients were 0.87 and 0.91. (Hancuff-Texas)
W70-10390

HIGH QUALITY REUSE WATER FROM A NEWLY DEVELOPED CHEMICAL-PHYSICAL TREATMENT PROCESS,
New York Univ., Bronx.
A. H. Molof, and M. M. Zuckerman.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-21. 21 p, 10 fig, 9 tab, 34 ref.

Descriptors: *Water reuse, Waste water treatment, *Activated carbon, *Filtration, *Chemical precipitation, Sewage treatment, Water quality, Absorption, Phosphate, Pilot plant.
Identifiers: Chemical-physical treatment, Z-M process, Water renovation.

A pilot plant study is made of a chemical-physical treatment process. The raw waste water is mixed with 8% calcium hydroxide slury to obtain a pH of 11.5. Mixing is provided by a propeller mixer and there is retention time of about one minute. A solid separator for flocculation and clarification maintains a surface loading of 560 GPD/sq ft. Sludges are moved continuously at a rate of 0.7 GPM. The liquid then passed to a hydraulic reaction chamber which has a detention time of about 80 minutes. From there the hydrolized waste water is passed into a neutralization tank for 7 minutes where 93% sulphuric acid is added and a pH of 7 maintained. The water is pumped to a sand filter operated at 3.2 GPM/sq ft and then to 5 downflow activated carbon absorber columns of 2 foot depth at a loading of 2.2 GPM/sq ft. Disinfection is obtained through ozonation. From this study it can be seen the process can produce 97% COD removal and greater than 95% phosphate removal. Total costs are about 19.5 cents per thousand gallons. (Hancuff-Texas)
W70-10391

MARINE WASTE DISPOSAL AT RIO DE JANEIRO--WATER QUALITY EVALUATIONS AND DESIGN,
Engineering-Science Inc., Arcadia, Calif.
E. C. Peixoto, C. A. Volpi, and J. Scherfig.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper HA-10. 8 p, 2 fig, 5 ref.

Descriptors: *Waste water disposal, *Evaluation, *Sewage treatment, Estuaries, Water quality, *Design, Waste water treatment, *Flotation.
Identifiers: Marine disposal, *Flotables, *Air flotation, Rio de Janeiro (Brazil).

The optimum design of an ocean disposal system is that combination of treatment and offshore dilution which meets the required receiving water quality criteria at the lowest overall cost for the life of the system. The most important factors which determine the optimum design are: (1) characteristics and treatment of the sewage, (2) oceanographic characteristics of the disposal site, (3) cost of treatment, (4) cost of outfall operation. Preliminary studies for the city of Rio de Janeiro indicated that significant reductions in overall cost of sewage disposal could be expected if effective flotables removal process, without separate sludge handling, could be incorporated in the system. A dissolved air flotation pilot plant was constructed and a total of seventeen tests were conducted under various operating conditions. The influent to the dissolved air flotation unit was degritted, screened and had undergone primary settling. The two independent variables evaluated in these tests were overflow rate in the air flotation tanks which varied between 2,000 GSFD and 6,000 GSFD and the amount of dissolved air released from the total influent to the air rotation tank. Little or no reduction in the concentration of the flotables occurred in these tests when the concentration of the influent was less than 0.80 mg/l. No significant variation in flotables removal with overflow rate in the flotation tank was observed. The amount of air released effected flotables removal significantly 0 to 3.4 m released air per liter showed significantly lower removal than 5.6 to 37.2 ml per liter. Effluent flotables concentration below 1 mg/l can be considered excellent and in higher effluent concentration may be satisfactory. (Hancuff-Texas)
W70-10392

RESPIROMETRIC DETERMINATION OF BOD,
Government Industrial Development Lab., Sapporo (Japan).
T. Nakata, and Y. Kumagai.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-22. 8 p, 5 fig, 1 ref.

Descriptors: *Biochemical oxygen demand, *Respiration, Instrumentation, *Oxygen demand, Aerobic bacteria, Measurements, *Microorganisms, Mathematical models.

The construction and efficiency of a respirometer and the results of some experiments concerning the microorganisms are presented. The apparatus consists of a reaction chamber as master controller, a measuring unit and a recorder. The reaction chamber includes a culture flask with a magnetic stirrer inside and a small vessel for carbon dioxide absorbant, a manometer for sending a pressure signal to a relay circuit and an electrolytic oxygen

generator with a copper sulphate electrolyte. When dissolved oxygen in a sample is consumed by microorganisms the same amount of carbon dioxide as that of the oxygen consumed is evolved by the respiratory action of the microorganism. The absorption of the carbon dioxide by the absorbant causes a decrease of pressure in the closed reaction system and the change of level of dilute sulphuric acid in the manometer closed the relay circuit. The oxygen generator produces oxygen which is fed to the reaction system at a constant rate until the initial pressure is restored. The amount of consumed oxygen is hence proportional to the intregral electroysis time. This method is known to be convenient to speedy measurements. Using glucose the BOD can be determined within 10 to 15 hours. At 20 deg if the measurement is taken at a higher temperature the result can be obtained in a few hours. (Hancuff-Texas)
W70-10393

MODULATION OF THE OXYGEN SUPPLY IN AN ACTIVATED SLUDGE PROCESS,
Degremont S. A., Malmaison (France).
J. Bernard, and R. Louboutin.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper II-6. 8 p, 9 fig 3 ref.

Descriptors: *Oxygenation, *Activated sludge, Irritation, Sewage treatment, Waste water treatment, Biological treatment, Efficiencies, Performance.
Identifiers: *Modulation, Blowers, Surface aerators.

Oxygen supply systems should be designed to take into account the following facts: (1) variation of the liquid level in the aeration tanks, (2) variation of the number of tanks in use, (3) variation in time, temporarily or permanently, of the nominal headloss of the air diffusion devices, (4) variation in the pressure conditions and ambient air temperature, (5) variation in number of air-generating units in use. The influence of these various parameters differ according to the sources of oxygenation employed. The positive displacement air blowers, centrifugal blowers, and mechanical surface aerators are discussed, with this in mind. The ability to vary rotary blowers to modulated rotary blowers by the use of multispeed motors make-up air compressors and continuous speed variation, is discussed. The modulation of centrifugal air blowers is discussed from the standpoint of insertion of local headlosses, modification of the inlet aerodynamic conditions of the blowers, electrical motor speed control, and adjusting both speed and inlet conditions of the blower. Modulation of surface aerators is also discussed. (Hancuff-Texas)
W70-10394

QUANTITY AND QUALITY RELATIONSHIPS FOR COMBINED SEWER OBERFLOWS,
San Francisco, Calif., and Engineering-Science, Inc., Oakland, Calif.
A. O. Friedland, T. G. Shea, and H. F. Ludwig.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-1. 16 p, 5 fig, 5 tab, 2 ref.

Descriptors: Monitering, *Flow, *Hydrology, *Mathematical models, *Hydrograph, *Storm runoff, Storage, Waste water treatment, Water pollution, Water quality.
Identifiers: Combined sewage.

The results of a one year program of wet and dry weather monitoring of five combined sewer systems and one storm sewer system in San Francisco, is presented. The time concentration profiles of combined sewage constituents follow a definite three-phase variation initially having characteristics of raw sewage increasing in the second phase to 125 to 200% of the characteristics of raw sewage, and receding in the third phase to levels of 10 to 25% of the characteristics of raw sewage. No correlation was found between the mass emission of constituents due to storm and the antecedent dry period, land use character, or rainfall intensity. Storm runoff emission equations for COD total suspended solids total nitrogen, ortho-phosphate phosphrous. Hexane extractable material and floatables can be used in conjuntion with dry weather flow, waste load cooefficient, a rainfall history, basin acreage and population to estimate waste water loads. Weather diversions contain twice the total nitrogen and ortho-phosphate phosphrous, 50 to 60% more total nitrogen and COD, 20% more floatables, and 10% more total suspended solids than the storm runoff fraction of the diversion alone would contain. The nitrogen and phosphrous emissions from secondary forms are significantly greater than emissions of these constituents from combined or storm sewage flows on an annual basis. (Hncuff-Texas)
W70-10395

BIOLOGICAL MONITORING OF THE EFFLUENT FROM A LARGE CHEMICAL WORKS IN A RIVER WHICH HAS SOURCES OF POLLUTION UPSTREAM,
Canadian Industries Ltd., Montreal (Quebec).
N. E. Cooke, R. M. Cooper, and T. W. Beak.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-28. 6 p, 2 fig, 4 ref.

Descriptors: *Monitoring, *Water pollution control, Rivers, Mathematical models, Probability, Statistics, Waste water treatment, Testing, Sampling.
Identifiers: *Biological monitoring, *Chemical pollution.

In order to protect themselves and reassure the control authority some forward looking chemical companies are undertaking biological monitoring before and after plant start-up. The effluent was to be discharged into the St. Clair river, where there was already considerable pollution. To complicate the development of the system to monitor the effluent from the new plant the existing pollution in the river was of a random nature indicating that there were intermittent discharges, or spills of pollutants from the industries situated upstream. Mathematically, the problem was to find a statistical method which would enable the company to separate the effects of its plant effluents from the random effects of other effluents coming down from upstream. The invertebrate fauna found on the bottom consisted almost entirely of Chironomidae Pelecypoda, Gaftropoda, and Oligiochaeta. Due to the presence of pollution the more sensitive organisms had already been eliminated. A series of charts were developed which would indicate the differences between the averages from upstream and downstream locations in each biological survey. This permits one to detect a significant change caused by material discharged through the outfall in spite of very large fluctuations in the number of animals caused by random discharges of polluting materials released upstream. (Hancuff-Texas)
W70-10396

PRECIPITATION OF PHOSPHATES FROM WATER AND WASTE WATER USING LANTANUM SALTS,
North American Rockwell Corp., Canoga Park, Calif. Atomics International Div.
H. L. Recht, M. Ghassemi, and E. V. Kleber.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-17. 12 p, 9 fig, 1 tab, 9 ref.

Descriptors: *Chemical precipitation, *Waste water treatment, *Water treatment, *Phosphates, *Tertiary treatment, Sewage treatment, Hydrogen, Ion concentration, Efficiencies, Soluability.
Identifiers: *Lanthanum, *Chemical treatment, Secondary treatment.

Lanthanum salts were investigated for precipitation of phosphates from water. Tests were made using pure solutions of ortho- and condensed phosphates and on secondary effluent. The results compared to results from similar tests using aluminum salts. With Lanthanum (III) residual phosphate in all cases tested was considerably lower over a much broader pH range than with Aluminum (III). La (III) unlike Al (III) was effective at natural waste water pH levels of 7 to 8. At a constant pH of 7, orthophosphate removal was directly proportional to quantity of added La (III), and their use for the treatment of waste water on a wide scale will not be limited by any supply shortage. Because the lanthanide salt will be expensive compared to aluminum or to alum, even with widescale application, their use in the treatment of waste water will probably require provisions for the recovery and re-use. (Hancuff-Texas)
W70-10397

PHYSIOCHEMICAL AND MICROBIOLOGICAL PROPERTIES OF URBAN STORM WATER RUNOFF,
Swedish Inst. for Surface Chemistry.
For primary bibliographic entry see Field 05G.
W70-10398

EXTENT OF POLLUTION BY STORMWATER OVERFLOWS AND MEASURES FOR ITS CONTROL,
Ministry of Construction, Tokyo (Japan).
K. Inaba.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper HA-8. 7 p, 4 fig, 1 ref.

Descriptors: *Water pollution, *Storm runoff, *Sewage, *Hydrology, *Hydrographs, Ponds waste water treatment, Mathematical model, Sewerage control, Water pollution control.
Identifiers: *Combined sewage.

A study of the quantity and quality of storm sewage from a combined sewerage system in Tokyo metropolis, was conducted in the period 1966-1967. Three interconnected aspects of the study are discussed: (1) the hourly variation of storm sewage and storm water quantity and quality in urban areas, (2) some considerations on the method of estimating these factors, (3) the control of storm sewage flow and quality. It is important to estimate the hourly variation of storm sewage or storm water quality as a function of rains at all intensities so that accurate measures can be taken for control based on a sound mathematical model. The several possibilities are investigated and it is concluded that in a combined system it was most economical and reasonable to divide the total pollution in storm sewage between the outfall sewer to the treatment works, a storage tank and storm sewage outflows. (Hancuff-Texas)
W70-10399

DEMINERALIZATION OF WASTE WATER BY ION EXCHANGE,
Los Angeles County Sanitation District, Calif.; and Federal Water Pollution Control Administration, Cincinnati, Ohio.
J. D. Parkhurst, C. Chen, C. W. Carry, and A. N. Masse.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-20. 15 p, 8 fig, 7 tab.

Descriptors: *Demineralization, *Waste water treatment, *Ion exchange, Performance, *Tertiary treatment, *Costs, Pilot plants, Efficiencies, Water supply, California.
Identifiers: Advanced waste treatment, *Regeneration, Total dissolved solids, Pomona (Calif.).

An ion exchange pilot plant was successfully demineralized waste water at Pomona, California, for almost three years. Cost estimates for the ion exchange process shows that blended water with 1/3 the influent total dissolved solids removed can be produced at a cost competitive with alternative sources of water in southern California. The system

consists of a two stage ion exchange process which reduces the influent TDS by 90%. After 500 cycles of operation no discernable decrease in efficiency of the unit has occurred. Activated carbon absorption regeneration levels are 1.1 lbs of sulphuric acid per cubic foot for the cation resin and 0.56 lbs of aqueous ammonia for the anion resin. These have produced regeneration efficiencies of 85 to 90% respectively. Brines total approximately 11% of the influent flow and backwash wastes total about 4%, but these can be recycled through the pretreatment system. Estimated costs including carbon pretreatment to produce a blended water of 667 mg/l TDS from an influent stream of 1,000 mg/l TDS is about 23 cents per thousand gallons. (Hancuff-Texas)
W70-10400

METHOD FOR MEASURING AEROBIC DECOMPOSITION ACTIVITY OF ACTIVATED SLUDGE IN AN OPEN SYSTEM,
Research Inst. for Water Resources Development, Budapest (Hungary).
Peter Farkas.
Fourth International Conference on Water Pollution Research, Prague, Czech., September 2-6, 1968. Preprint, Sec, II, Paper 1. 9 p, 6 fig, 1 tab, 15 ref.

Descriptors: *Activated sludge, *Kinetics, *Oxygen demand, Aerobic treatment, Measurement, Respiration.
Identifiers: *Aerobic decomposition, Sludge activity.

Methods of sludge activity measurement are of great significance, since the activity indicates the concentration of living bacteria in the sludge, and its physiological conditions. The best index for sludge activity would be the substrate removal rate itself, if it were possible to measure it in a direct and simple way. An activity measurement procedure was elaborated relying upon the measurement of changes in the steady-state DO concentration of continuously aerated sludge samples. For decomposition activity measurement only substrates supplying oxygen deficiency curves with a sharp breakdown at their total removal may be used, since only in the case of such substances can the decomposition time be determined exactly. Decomposition activity shows linear proportionality to the bacterial concentration of the sludge. Acetate was added to sludge samples in concentrations ranging from 50 to 200 mg/l in order to obtain decomposition times ranging from 80 to 300 min; acetate being in excess above a concentration of 50-100 mg/l, the measured activities depended mainly on the sludge concentrations. The activity vs. substrate concentration functions were found to be different for the non-toxic acetate and the toxic compound, phenol. In the case of acetate, above a concentration of about 100 mg/l, activity was nearly independent of the value of acetate supply. With phenol, the activity vs. substrate function showed a maximum value at 20 mg/l, higher concentrations exerting a toxic effect and thus reducing activity. (Aguirre-Texas)
W70-10402

WATER POLLUTION AND THE TEXTILE INDUSTRY,
W. J. Cosgrove.
Canadian Textile Journal, Vol 87, No 1, 1970, p 63-66. 1 tab.

Descriptors: *St. Lawrence River, Biochemical oxygen demand, Hydrogen ion concentration, Algae, *Entrophication, Neutralization, Sedimentation, Trickling filters, Waste water treatment.
Identifiers: *Textile mill wastes, Montreal, Balancing tanks.

There was a dramatic reduction in the incidence of typhoid fever due to improvements in water supplies in the years 1906 to 1923, at which time the importance of typhoid carriers was discovered. The City of Montreal now faces problems of sewage disposal and the formation of algal blooms in near by rivers and lakes. The textile industry is one of several sources of wastes which adds to the problem. The BOD's and pH's of typical textile wastes are tabulated. About three quarters of the textile plants discharge their wastes to sewers and the remainder to rivers. Treatments used for textile wastes depend upon balancing tanks, neutralization, sedimentation, trickling filters and the use of specific operations and chemical treatments dectated by the particular processing operations and chemicals involved. (Work-North Carolina State)
W70-10427

HOLLOW FIBER PERMEATORS IN INDUSTRIAL WASTES STREAM SEPARATIONS,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
W. P. Cooke.
Desalination, Vol 7, No 1, 1969, 31-46, 13 fig, 3 tab, 2 ref.

Descriptors: *Waste water treatment, Osmosis, *Water reuse, *Membrane processes, Membranes.
Identifiers: Pulp mill wastes, Sugar refinery wastes, Whey, Nylon fibers.

Hollow nylon fibers having diameters of about 45-50 microns are useful as the basis of water permeation equipment. The basic principles involved are well known and calculations of through put is easily made. Performance depends upon area, pressure, temperature, the permeability coefficient of the membrane for water, the osmotic pressure across the membrane and the thickness of the wall of the tubular fibers. It is considered that this type of installation may have useful applications in the purification of waste waters which pose problems when emptied directly into streams. Examples given are for whey processing, pulp mill wastes and sugar refinery wastes. (Work-North Carolina State)
W70-10431

TEXTILE EFFLUENTS AND THEIR SAFE DISPOSAL,
N. A. P. Perera.
Silk and Rayon Industries of India Vol 12, No 11, 1969, 555-574, 7 diag, 6 tab, 41 ref.

Descriptors: Cotton, Acids, Suspended load, Heavy metals, *Waste disposal, *Waste water disposal, Waste water treatment.
Identifiers: *Textile mill wastes, *Dyehouse wastes, Man-made fibers, Desizing, Kier scouring, Bleaching, Mercerizing, Dyeing, Silk, Silk degumming, Wool, Wool scouring, Wool grease, Jute, Rayon, Nylon, Acrylic fibers, Cellulose acetate fibers.

Polluting materials from the processing of textiles are (1) acids and alkalis, (2) organic matter, (3) toxic materials, especially compounds of heavy metals such as lead, copper chromium and the like, (4) suspended solids, (5) oils and greases, and (6) dyes and other colorants. Treating methods are (1) physical such as screening and settling, (2) chemical such as neutralizing or other chemical reactions and floculation and precipitation and (3) biological. These several treating methods are discussed and examples of operatins are illustrated with diagrams and flow charts. The processing if described of cotton fabrics by desizing, kier boiling, bleaching, mercerizing and dyeing with the waste products to be expected. Silk degumming and bleaching are discussed. Scouring of raw wool and recovery of wool grease, the retting of flax and the scouring and dyeing of jute are covered. The behavior of detergents, new developments in this field and the disposal of these materials in waste waters are presented. The manufacture of cuprammonium rayon the dyeing of this and also viscose rayon, the manufacture of cellulose acetate fibers, nylon fibers, acrylic fiber, are touched upon from the standpoint of process chemicals and the disposal of wastes. Laundry wastes and their handling are discussed. Examples of the recovery of useful products such as potassium salts and grease from wool scouring, arsenates and phosphates and alizarin dye from other process are described. (Work-North Carolina State)
W70-10432

TREATMENT OF WASTE FROM POLYESTER MANUFACTURING OPERATIONS,
Fiber Industries, Inc., Charlotte, N.C.; and Davis and Floyd Engineers, Inc., Greenwood, S.C.
C. E. Steinmetz, and W. J. Day.
Chamical Engineering Progress, Symposium Series Vol 65, No 97, 1969. p 188-190.

Descriptors: *Water reuse, *Reclaimed water, Organic compounds, Chemical wastes, Ion exchange, Biochemical oxygen demand, Chemical oxygen demand, Color, Activated sludge, Algae, Waste water treatment.
Identifiers: *Polyester fibers, Man-made fibers, Methyl alcohol, Ethylene glycol, Polymers, Dimethyl terephthalate.

This is a progress report to May 1969, on a water reuse project, jointly undertaken by the Shelby Plant of Fiber Industries, and the FWPCA. This plant applies a lubricant, or so-called 'fiber finish', to the polyester fiber manufactured there. It is of a proprietary nature but for purposes of waste treatment schemes may be considered a long chain fatty acid or derivative thereof. This material, blow down water from the power plant, and small amounts of chemical wastes, including methyl alcohol, ethylene glycol, dimethyl terephthalate, low molecular weight polymer and titanium dioxide, ion exchange recharge chemicals, housekeeping and laboratory wastes are the essential waste products. In a pilot plant study the waste water previously treated in an extended aeration activated sludge system is further treated. As received it has a color of 50 units, C.O.D. of 280-300 ppm and B.O.D. of 8-24 ppm. Algae are removed by screening and a carbon unit reduces the color to 10 units, C.O.D. to 125 ppm and B.O.D. to 4 ppm. One half of this water is discharged and the rest returned to the system after cooling and removal of chromium and zinc salts. (Work-North Carolina State)
W70-10433

TREATMENT OF WASTES FROM COTTON TEXTILE INDUSTRY,
V. Rama Rao.
Technology, Special Issue 3, Vol 4, p 56-58, 1966.

Descriptors: *Cotton, Pretreatment (Water), *Coagulation, Lime, Gypsum, Settling basins, *Filtration, Filters, Separation techniques, Waste water treatment.
Identifiers: Bleaching, *Dyehouse wastes, Fibrous solids, Suspended solids.

The volume of waste water discharged from 87 cotton textile mills at Ahmedabad (India) varies between 10,000 and 3,000,000 gallons per day. Waste waters are chiefly from bleaching and dyehouse operations and contain fibrous and suspended solids. Owing to great variations in the characteristics of the waste water, it is not appropriate to mix it directly with sewage and to treat them in a combined treatment plant. The modified pretreatment methods of waste treatment in each plant were worked out, which consists of coagulation by lime and gypsum followed by sedimentation and filtration through a gypsum filter. (Livengood-North Carolina State)
W70-10434

WASTE DISPOSAL BY TEXTILE PLANTS,
Chatham Mfg. Co., Elkin, N.C.
Arthur L. Smith.
Water Pollution Control Federation Journal, Vol 37, No 11, p 1607-1613, November 1965. 3 fig, 3 tab.

Descriptors: *Biochemical oxygen demand, Acidity, Alkalinity, Suspended load, Dissolved solids,

Color, Foaming, Toxicity, Scum, Water pollution, Equalizing reservoirs, Flow control, Temperature control, Anaerobic digestion, Waste storage, Aeration, Hydrogen ion concentration, *Waste disposal, Waste water treatment.
Identifiers: *Textile wastes, Antibacterial finishes, *Dyehouse wastes.

The biochemical oxygen demand, acidity or alkalinity, suspended solids, dissolved solids, color, foam, toxicity, and bacteriostatic materials are the major water pollutents from textile operations. Solids may be removed by mechanical, physical-chemical, or semibiological methods. Secondary treatment may include pH adjustment, chemical or time equalization, flow or temperature control, anaerobic lagooning, and aeration. The current trend in textile waste treatment is toward the aeration technique. Treatment operations at plants of the Chatham Manufacturing Company and J. P. Stevens Company are discussed. Biochemical oxygen demand, scum, and dissolved oxygen content problems are emphasized. (Lonon-North Carolina State)
W70-10435

PLANT FOR TREATMENT OF EFFLUENTS.
Ames Crosta Mills and Co., Heywood (England).

Textile Manufacturer, Vol 89, No 1057, p 34, January, 1963.

Descriptors: *Waste water treatment, Screens, Solid wastes, *Pulp wastes, Neutralization, Settling basins, Chemical precipitation, Flocculation, Biological treatment, Activated sludge, Biochemical oxygen demand, Sludge, Trickling filters.
Identifiers: *Textile mill wastes, Balancing tanks.

In designing a waste treatment plant, it must first be decided whether treatment could be reduced within the mill itself. However, this decision is limited in textile operations, as textile wastes are derived from necessary removal of material from the product. Screening removes large solids and fibrous matter. Neutralization should precede settlement. Further chemical treatment, precipitation and flocculation, if needed, must be followed by settlement. Biological treatment, using trickling filters or activated sludge, is often necessary to remove excessive biochemical oxygen demand and must be followed by settlement. Chemical wastage and increased sludge production, which often occur because of inadequate treatment, justify careful consideration of a suitable treatment plant. Balancing tanks should be considered. (Work-North Carolina State)
W70-10436

A REVIEW OF THE LITERATURE OF 1966 ON WASTE WATER AND WATER POLLUTION CONTROL,
C. M. Weiss.
Journal Water Pollution Control Federation, Vol 39, No 7, p 1049-1154, July 1967. 917 ref.

Descriptors: *Waste water treatment, *Biological treatment, *Water pollution control, Fish, Toxicity, Fresh water, Pulp wastes, Pesticide residues, Herbicides, Estuaries, Water quality, Detergents, Algal control, Industrial wastes, Thermal pollution, Methodology, Instrumentation, Sea water.
Identifiers: Metal toxicity.

A review of papers published during 1966 is presented. Material covered includes: biological studies evaluating water pollution, causes of fish mortality, toxic nature of substances in fresh water, water quality, detergents as related to algal growth and fish damage, domestic and industrial waste treatment, metal toxicity assay, effect of wastes from the pulping and forest industries, the potential hazards from pesticide and herbicide residues, effect of thermal discharges, physiological and pathological conditions in fish caused by toxic compounds, methodology and instrumentation, and estuarine and marine pollution. (Livengood-North Carolina State)
W70-10437

5E. Ultimate Disposal of Wastes

DISPOSAL OF BRINE BY SOLAR EVAPORATION: DESIGN CRITERIA,
New Mexico State Univ., Las Cruces.
C. G. Keyes, Jr., W. S. Gregory, N. N. Gunaji, and J. V. Lunsford.
For sale by Supt. of Documents, U S Government Printing Office, Wash., D C 20402 - Price $1.25 per copy. Office of Saline Water Research and Development Progress Report No 564, May 1970. 123 p, 15 tab, 30 fig, 52 ref, 5 append. OSW Contract No 14-01-0001-969.

Descriptors: *Brine disposal, Evaporation, Energy balance, *Mathematical models, *Computer models, Solar radiation, Heat balance, Heat budget, Waste water disposal, Brines, Water temperature, New Mexico, Desalination plants.
Identifiers: *Evaporation rates, Brine evaporation, Design criteria, Solar ponds, Evaporation basins, Roswell (New Mexico).

Design criteria for disposal of brine by solar evaporation was investigated. A heat transfer model and a diffusion model were used as the main components of the criteria. Model studies showed that the use of a small depth resulted in higher brine temperatures. A 2-inch depth gives an average difference of six degrees centigrade throughout the year for conditions at the Roswell, New Mexico ponds. The heat transfer model was also useful in predicting the surface temperature of deeper basins. A wind directional analysis was used to acquire insight into the proper orientation for the influent disposal basin. The results of this analysis indicated that a Roswell basin should be constructed with its longitudinal axis on an azimuth of 165 degrees. (See also W70-09355 and W70-09243) (Rinne-Office of Saline Water)
W70-10085

MARINE WASTE DISPOSAL AT RIO DE JANEIRO--WATER QUALITY EVALUATIONS AND DESIGN,
Engineering-Science Inc., Arcadia, Calif.
For primary bibliographic entry see Field 05D.
W70-10392

TEXTILE EFFLUENTS AND THEIR SAFE DISPOSAL,
For primary bibliographic entry see Field 05D.
W70-10432

WASTE DISPOSAL BY TEXTILE PLANTS,
Chatham Mfg. Co., Elkin, N.C.
For primary bibliographic entry see Field 05D.
W70-10435

5F. Water Treatment and Quality Alteration

POTABLE WATER WITH BULRUSHES: NEW STRATEGY AGAINST WASTE WATER PROBLEMS.
Northeastern Wisconsin Regional Planning Commission, Appleton; and Scientific Translation Service, Ann Arbor, Mich.

Trans. from German (Medical Tribune). n. d. 6 p. Supported by a HUD grant.

Descriptors: *Potable water, *Bulrush, *Water pollution treatment, *Waste water (Pollution), Phenols, Industries, Nutrients, Metabolism, Organic matter, Toxins, Biochemistry, Assay, Tracers, Self-purification, Water treatment, Coliforms, Enteric bacteria, Salmonella, Eggs, Water quality.
Identifiers: Metal salts, Rhine (Germany), Central Africa, Scirpus lacustris, Heterotrophism, Lindau (Germany), Phytoncides, Polycyclic phenolcarboxylic acid.

The Lindau Public Works Department on the Rhine instigated extensive test series with phenol concentrations of varying degrees under different conditions based on information that bulrushes (Scirpus lacustris) remove metal salts as well as phenols from waste water. They proved that bulrushes not only thrive in phenol-containing water but showed improved growth at higher phenol concentrations; S lacustris evidently utilized phenol extracted from the water as a nutrient or agent for synthesis. Only at an extreme phenol concentration of 900 to 1000 milligrams/liter did the bulrushes exhibit inhibited growth or mortality. Using quantitative and qualitative biochemical assays and tracer techniques biochemists confirmed that the bulrush can use the toxins as building blocks for its protein, for example, synthesize aspartic acid or alanine from waste water phenol. The bactericidal action of the bulrush is attributed to a phytoncide, one fraction of which has already been enriched; evidently this is the acid fraction of the plant, apparently a polycyclic phenolcarboxylic acid. Large-scale projects based on this principle would mean degradation of city wastes by a growth of bulrushes along meandering waterways as a third treatment stage. (Jones-Wisconsin)
W70-10406

5G. Water Quality Control

JOINT CONFERENCE ON PREVENTION AND CONTROL OF OIL SPILLS.
American Petroleum Inst., New York; and Federal Water Pollution Control Administration, Washington, D.C.

Available from NTIS as PB-194 395, $3.00 in paper copy, $0.65 in microfiche. Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Institute, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Institute, New York, 1970. 345 p. FWPCA Project 15080 EIL---12/69.

Descriptors: *Oily water, *Water pollution sources, *Water pollution treatment, *Water pollution control, Monitoring, Surfactants, Water analysis, Biodegradation, Path of pollutants, Ecology, Data storage and retrieval, Data collections.
Identifiers: Oil spills.

On December 15-17, 1969, a Joint Conference on Prevention and Control of Oil Spills was held under the cosponsorship of the American Petroleum Institute and the Federal Water Pollution Control Administration. The objectives of the conference were to delineate the overall dimensions of the oil spills problem, explore the present state of the art of prevention and control of oil spills, and review the relevant research and development efforts of government and private industry, both here and abroad. The topics discussed include spill prevention, boom design, mechanical removal, chemical additives, analysis and sampling, monitoring, beach cleanup, fate of spills, ecological effects, and oil-spill information retrieval and dissemination. (See also W70-10036 thru W70-10049). (Knapp-USGS)
W70-10035

UNITED KINGDOM MINISTRY OF TECHNOLOGY WORK ON OIL POLLUTION,
Warren Spring Lab., Stevenage (England).
J. Wardley Smith.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 27-40, 1970. 14 p, 3 fig, 4 tab.

Descriptors: *Water pollution sources, *Water pollution treatment, *Water pollution control, Oily water, Oil industry, Ships, Oil wells, Oil-water interfaces, Oil wastes, Beaches.
Identifiers: Oil spills, United Kingdom.

The work of the research laboratories of the United Kingdom Ministry of Technology in the field of oil pollution is described. It includes the removal of oil from beaches and from the sea, the burning of oil in tanks, and the use of booms in sheltered waters. In 1960, there were a number of fairly large-scale oil pollution incidents off the south coast of England. Treatment of oil on beaches, methods of dealing with oil on the sea, the burning of oil in tanks, the use of booms to protect particular sites, and other means of preventing oil from reaching the surface of the sea are described. (See also W70-10035). (Knapp-USGS)
W70-10037

OIL POLLUTION CONTROL ON THE BUFFALO RIVER,
Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Observation Sciences Dept.
Ronald L. Frank.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 129-136, 1970. 8 p, 10 fig, 1 tab, 1 ref.

Descriptors: *Water pollution control, *Water pollution treatment, *Oily water, Rivers, New York, Aeration, Water pollution sources.
Identifiers: Buffalo River (N Y).

Two main systems were developed to control oil pollution on the Buffalo River, N.Y.: the upper river system uses surface oil booms and the lower river system uses an underwater air barrier. The basic design of the air barrier is discussed, along with the results of laboratory and field testing. The sampling and analysis phase of oil retrieval and the use of surface chemical displacing compounds are summarized. (See also W70-10035). (Knapp-USGS)
W70-10038

CHEMICAL TREATMENT OF OIL SPILLS,
Federal Water Pollution Control Administration, Edison, N.J. Water Quality Lab.
E. J. Struzeski, Jr., and R. T. Dewling.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 217-222, 1970. 6 p, 2 tab, 19 ref.

Descriptors: *Water pollution control, *Water pollution treatment, *Oily water, Surfactants, Absorption, Burning.
Identifiers: Oil spills, Oil spill treatment.

Chemical treatment methods have been used at all recent major oil spills with varying degrees of success. Technical information is presented on the applicability and effectiveness of the various chemicals and materials presently available for preventing and for controlling oil spills. Special emphasis is given to techniques designed to absorb and gel oils floating on the water surface, to sink oils, and to permit burning of the oil mass upon open waters and affected shorelines. The impact, consequences and damages of small and large oil spills are briefly mentioned. (See also W70-10035). (Knapp-USGS)
W70-10039

STUDY OF EQUIPMENT AND METHODS FOR REMOVING OIL FROM HARBOR WATERS,
Battelle Memorial Inst., Richland, Wash. Pacific Northwest Lab.; and Bureau of Commercial Fisheries, Ketchikan, Alaska.
P. C. Walkup, L. M. Polentz, J. D. Smith, and P. L. Peterson.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 237-248, 1970. 12 p, 1 fig, 6 tab, 5 ref.

Descriptors: *Water pollution control, *Water pollution treatment, *Oily water, *Cost analysis, Equipment, Cost-benefit analysis, Surfactants, Decision making.
Identifiers: Oil spills.

A cost effectiveness analysis was performed for equipment, materials, and techniques for the removal of spilled petroleum products from the surface of port and harbor waters used by U.S. Naval craft. Effectiveness criteria, formulated for present methods and presently available equipment and materials, included speed of application, completeness of removal, ease of operation, effect on marine life, operating continuity, and availability. Parameters for the effectiveness study were based on the petroleum products now in use or those planned for future use and a detailed review of the geographic, hydrographic, physical, and environmental characteristics of ports used by the U.S. Navy. The two most cost-effective systems for broad application were found to be mechanical recovery of spilled material by surface suction devices, supplemented by mechanical containment, and the application of chemical dispersants by pier- or vessel-mounted high pressure spray equipment. (See also W70-10035). (Knapp-USGS)
W70-10040

CONFINEMENT AND CONTROL OF OIL POLLUTION ON WATER WITH MONOMOLECULAR SURFACE FILMS,
Naval Research Lab., Washington, D.C. Chemical Oceanography Branch.
William D. Garrett.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 257-261, 1970. 5 p, 8 fig, 1 tab, 7 ref.

Descriptors: *Oily water, *Water pollution control, *Monomolecular films, *Surfactants, Water pollution treatment, Octadecanol.
Identifiers: Oil spill treatment.

Under favorable conditions monomolecular surface films can be used to guide, confine and condense petroleum spills on water. Composed of water-insoluable, non-toxic organic material, these films spread rapidly and spontaneously into a one-molecule-thick layer. Consequently, small quantities of film material will clear thin oil layers from large areas of a water surface. The effects of wind, the chemical character of the pollution and its thickness upon the usefulness of the film is discussed. In addition to clearing water surfaces of oil, one of the most useful applications may be the ability of the surface film to confine and condense a small oil spill into layers as thick as one centimeter. Since the petroleum is thickened and compressed into a much reduced surface area, the efficiency of oil retrieval techniques would be enhanced. (See also W70-10035). (Knapp-USGS)
W70-10041

NEW METHODS FOR COMBATTING OIL SLICKS,
Koninklijke-Shell Exploratie en Produktie Laboratorium, Rijswijk (Netherlands).
F. H. Meijs, L. J. Schmit Jongbloed, and H. J. Tadema.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 263-269, 1970. 7 p, 13 fig.

Descriptors: *Oily water, *Water pollution control, *Water pollution treatment, Absorption, Surfactants, Burning, Equipment, Ships.
Identifiers: Oil spill treatment.

A new device was developed to clean spilled oil from water. It incorporates the principle of continuous operation by means of a floating and circulating absorbent belt. The apparatus operates satisfactorily under practical conditions on inland waters. Oil slicks at sea can be sunk by means of sand that has been rendered oil-wet by the addition of special wetting agents. This can be accomplished in one fast operation by using a sea-going hopper dredger which first gathers the sand from the sea bottom and stores it still wet in its hoppers. At the site of the oil slick, after fluidization of the sand with water and addition of a small amount of chemical, the sand/water slurry is sprayed over the floating oil. This method was shown to have practical potential by large-scale tests with a dredger. Both from an economic and an operational point of view, this seems to be the only potentially viable way of attacking really large oil spills on the sea. (See also W70-10035). (Knapp-USGS)
W70-10042

POLLUTION CONTROL AT A MAJOR OIL SPILL,
Union Oil Company of California, Los Angeles. Dept. of Air and Water Conservation.
T. H. Gaines.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY; published by American Petroleum Inst, New York, p 271-280, 1970. 10 p, 2 tab, 4 append.

Descriptors: *Oily water, *California, *Water pollution treatment, Oil industry, Water pollution control, Surfactants, Burning, Oil fields, Oil wells.
Identifiers: *Oil spills, *Santa Barbara Channel (Calif), Oil spill treatment.

The eruption of crude oil from the ocean floor five and one-half miles offshore from Santa Barbara, California on January 28, 1969, created a substantial task of pollution control and property cleanup. In spite of all difficulties encountered, the beaches, harbors, houses, boats and shoreline have been restored, and in some cases, exceed their original beauty and cleanliness. The cleanup has been costly and time-consuming. More than $4,500,000 has been spent in the prevention of pollution and restoration of property and the environment. (See also W70-10035). (Knapp-USGS)
W70-10043

IDENTIFICATION OF OIL SPILLS: COMPARISON OF SEVERAL METHODS,
Melpar, Inc., Falls Church, Va.
For primary bibliographic entry see Field 05A.
W70-10044

REMOTE SENSING OF OIL SLICKS,
Federal Water Pollution Control Administration, Washington, D.C. Div. of Water Quality Research.
For primary bibliographic entry see Field 05A.
W70-10045

MICROBIAL MODIFICATION OF CRUDE OIL IN THE SEA,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 05B.
W70-10046

MICROBIAL DEGRADATION OF NORMAL PARAFFIN HYDROCARBONS IN CRUDE OIL,
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W70-10047

KINETICS OF DISSIPATION AND BIODEGRADATION OF CRUDE OIL IN ALASKA'S COOK INLET,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 05B.
W70-10048

FLUID DYNAMICS OF FLOATING OIL CONTAINMENT BY MECHANICAL BARRIERS IN THE PRESENCE OF WATER CURRENTS,
Shell Pipe Line Corp., Houston, Tex. Research and Development Lab.
Moye Wicks, III.
Proceedings of Joint Conference on Prevention and Control of Oil Spills, American Petroleum Inst, and Federal Water Pollution Control Admin, Dec 15-17, 1969, New York, NY, published by American Petroleum Inst, New York, p 55-106, 1970. 52 p, 1 fig, 2 tab, 26 ref, 4 append.

Descriptors: *Running waters, *Water pollution control, *Oily water, Computer programs, Water pollution treatment, Oil industry, Laboratory tests, Ships, Oil-water interfaces, Oil wastes, Currents (Water), Turbulence, Flow, Open channel flow, Hydraulic models, Flumes.
Identifiers: Oil spills.

Experiments on oil containment by mechanical barriers led to identification of the important physical phenomena controlling the extent of an oil slick and illustrate flow conditions leading to failure of the barrier. A mathematical model has been developed to generalize the experimental results. Three regions in the oil layer are identified. A gravity wave region near the upstream end of the slick, which leads to oil droplet formation if water flows faster than a certain critical speed; a boundary layer region where drag of the flowing water causes gradual thickening of the oil; and a skirt region where the flowing water causes oil droplets still present to be swept under the barrier. Failure is also possible when oil can escape under the boom by a kind of draining action. Example calculations and design charts are presented to be used in deciding whether stationary mechanical barriers would work at all in given cases, and in selecting the proper depth of skirt and length of boom required in those cases where mechanical barriers are feasible. Where stationary barriers are not feasible, the results can be used to establish minimum boom drift velocity to prevent oil from escaping. (See also W70-10035). (Knapp-USGS)
W70-10049

WATER IN URBAN PLANNING, SALT CREEK BASIN, ILLINOIS--WATER MANAGEMENT AS RELATED TO ALTERNATIVE LAND-USE PRACTICES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04C.
W70-10070

SIMULATION OF SPATIAL AND TEMPORAL CHANGES IN WATER QUALITY WITHIN A HYDROLOGIC UNIT,
Montana State Univ., Bozeman. Dept. of Civil Engineering; and Utah Water Research Lab., Logan.
N. Dixon, and D. W. Hendricks.
Water Resources Bulletin, Vol 6, No 4, p 483-497, July-August 1970. 15 p, 2 fig, 5 tab, 12 ref. FWQA Grant No WPD-17-03.

Descriptors: *Mathematical models, *Systems analysis, *Water management (Applied), *Water resources development, Simulation analysis, Water quality, Water yield, Aquifers, Reservoir operation, Reservoir design, Waste water disposal, Waste disposal, Water pollution control, Utah, Gaging stations, Data collections, Sampling, Hydrogeology, Computer programs.
Identifiers: Water resources management.

Water quality must be considered in the development and planning aspects of water resource management. To accomplish this, the decision-maker needs to have at his disposal a systematized procedure for simulating water quality changes in both time and space. The simulation model should be capable of representing changes in several parameters of water quality as they are influenced by natural and human factors impinging on the hydrologic system. A water quality simulation model was developed in conjunction with a hydrologic simulation model. The model represents water quality changes in both time and space in response to changing atmospheric and hydrologic conditions and time-varying waste discharges at various points in the system. This model has been developed from and verified with actual field data from a prototype system. Procedural guidelines are given to assist in the development of water quality simulation models as tools for use in the quality-quantity management of a hydrologic unit. (Knapp-USGS)
W70-10077

EFFECTS OF WATER IMPOUNDMENTS ON REPRODUCTION AND POPULATION NUMBER OF WATERFOWL ON THE SNAKE RIVER, WASHINGTON,
Washington State Univ., Pullman. Dept. of Wildlife Biology.
For primary bibliographic entry see Field 06G.
W70-10117

PHYSICAL AND ECONOMIC FACTORS ASSOCIATED WITH THE ESTABLISHMENT OF STREAM WATER QUALITY STANDARDS, VOLUME II,
Iowa State Univ., Ames. Engineering Research Inst.
M. D. Dougal, E. R. Baumann, and J. F. Timmons.
Available from NTIS as PB-194 551, $10.00 in paper copy, $0.65 in microfiche. Completion Report ISU-ERI-Ames-6400, April, 1970. 646 p, 120 tab, 88 fig, 330 ref. OWRR Project A-001-IA (6).

Descriptors: Economics, *Mathematical models, Path of pollutants, *Waste assimilative capacity, *Water quality, *Water pollution control, *Biochemical oxygen demand, Computers, Dissolved oxygen, *Quality standards, Rivers, Sewage treatment, Simulation, Streams.

A comprehensive study is reported of water pollution control and stream water quality as they relate to the establishment of stream and effluent standards. The ability of Iowa streams to assimilate organic wastes was determined on a state-wide basis, with three hydrologic-water quality regions being identified: Ideal, Good, and Poor. Quantitative values were assigned for low flow discharges in each region. The preliminary results indicate that the BOD loading in the streams must be limited to 10 - 15 mg/l to maintain the established dissolved oxygen standard of 4 mg/l. The physical characteristics of effluents from typical waste treatment processes were determined and related to mathematical models for BOD progression. A more refined BOD model was developed. A case study of the Skunk River at Ames revealed the nature of the response of an Iowa stream to discharge of effluents from a water pollution control plant. A digital computer model was developed for simulating, verifying and forecasting stream water quality. The results indicate three major factors influence stream quality: oxidation of the carbonaceous organic wastes contained in effluents, nitrification of nitrogenous compounds, and the effect of nutrient levels in causing a substantial algal response. The economic value of water pollution control was evaluated for the City of Ames. Present annual expenditures will double or triple in the future depending on the desired level of stream water quality. (See also W70-06094)
W70-10123

SELECT RESERVOIR WITHDRAWAL BY MULTILEVEL INTAKES,
Army Engineer District, Savannah, Ga.
For primary bibliographic entry see Field 08A.
W70-10147

EFFECTS OF RESERVOIR IMPOUNDMENT ON WATER QUALITY,
Army Engineer District, Savannah, Ga.
Frank H. Posey, Jr., and Joseph W. DeWitt.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No PO1, p 173-185, Jan 1970. 13 p, 5 fig, 10 ref, 2 append.

Descriptors: *Reservoir storage, *Reservoirs, *Impoundments, Intakes, *Water quality, Submerged weirs, Effects, Thermal stratification, *Water quality control, Stratification, Withdrawal, Outlets, Aeration, Pumping, Tailrace, Turbines, Dissolved oxygen, Reservoir operation, Reaeration.
Identifiers: Effect, Multilevel outlets, Diffused air pumping system, Selective level releases, *Destratification (Thermal).

Correcting adverse effects of thermal stratification and low dissolved oxygen content in large reservoirs, and controlling physical, chemical, and biological parameters of released water from impoundments in the southeastern United States are described. Results of water quality investigations at the Clark Hill and Hartwell Reservoirs are outlined along with predictions of quality expected at West Point Reservoir. Comparisons are made of various possible corrective solutions investigated such as: (1) multilevel penstock intakes, (2) submerged weirs, (3) tailrace and turbine aeration, and (4) destratification systems. Emphasis is placed on a diffused air pumping system prototype equipment test at Allatoona Reservoir in northern Georgia. The destratification equipment and types and methods of sampling and data processing are described. (USBR)
W70-10148

CONTROL OF AQUATIC PLANT NUISANCES (ESPECIALLY ALGAE) WITH SOME SUBSTITUTED PHENYLUREAS,
Ivonne J. Le Cosquino de Bussy.
Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol 17, p 539-545, 1969. 1 fig, 4 tab, 9 ref.

Descriptors: *Aquatic plants, *Nuisance algae, *Algicides, *Phenols, *Water quality control, Crustaceans, Rotifers, Swimming pools, Chlamydomonas, Daphnia, Diatoms, Chlorella, Scenedesmus, Oxygen, Coliforms, Sediments, Mud, Sands, Sludge, Recreation.
Identifiers: *Phenylureas, Diuron, Flagellates, Monuron, Transparency, Cyclops, Scenedesmus obliquus, Dactylococcus, Escherichia coli, Oocystis, Lemna, Spirodela, Elodea.

The requirement in the Netherlands for a good means of controlling algae nuisance in open-air flow-through swimming pools or in recreational ponds, fostered research with substituted phenylureas. These herbicides are inhibitors of photosynthesis. Higher submerged water plants and filamentous algae can be controlled very well by the application of diuron in early April in dosages varying from 0.2 to 0.4 ppm. In order to control microalgae in swimming pools and to obtain a transparency of 100-250 centimeters a higher dose is necessary, the growth of Crustacea, which eat small algae being desirable at the same time. The addition of diuron should be effected in clear water preferably with an initial dose of one ppm. In smaller swimming pools the concentration of diuron must be above 0.6 ppm in order to obtain a transparency of 120-240 centimeters. In large swimming pools (6000 cubic meters) a transparency from 170-270 centimeters could be maintained even during the time when the diuron in the water was no longer detectable. (Jones-Wisconsin)
W70-10161

PHYSICAL AND MATHEMATICAL MODEL STUDIES OF SURFACE CURRENTS,
Hydraulics Research Station, Wallingford (England).
I. W. M. Moir, and J. M. Willians.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint 6 p, Fig. 2.

Descriptors: *Estuaries, *Physical models, *Mathematical models, Winds, Currents, Correlation analysis, Model studies.
Identifiers: *Surface currents, Graphical presentation.

Physical and mathematical models based on field observations have been developed for analysis of wind and tide effects on surface water currents. Investigation into sea disposal have been conducted on the Tyne and Tees estuaries and Firth of Forth. A six month program of field work was undertaken for each of the investigations. Current observations were obtained, by direct reading and recording instruments at five depths, over a tidal cycle at a number of locations. The movement of surface water was tracked by drogues. The current measurements and associated wind observations from each investigation were analyzed for correlation between wind and wind-induced currents, and for information on basic current drift in the absence of wind. A graphical method of presentation of the data is also shown in this paper. Results showed a high significance level for the basic regression equation, but low correlation coefficients, indicating considerable scatter. Further work is therefore needed to identify systematic components in the error vectors. (Upadhyaya-Vanderbilt)
W70-10206

MATHEMATICAL MODEL TECHNIQUES FOR COASTAL WATERS,
Edinburgh Corp. (Scotland).
D. Haverson.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, 5 p.

Descriptors: *Mathematical models, Potential flow, *Wind, *Currents, Tidal effects, Frequency.
Identifiers: *Coastal waters, Least squares fit, Tidal cycle.

The subject of the model is the structure of the flow patterns in the layer of water 1.5 meters below the surface of the region under investigation. Purpose of the model is to predict the track of a drogue centered in this layer, for any conditions of wind and tide. The main data consists of sets of wind/current readings, the latter at a depth of 1.5 meters, at half-hourly intervals. A relation between wind and wind-enduced current in the area is derived. Two methods are combined in the construction of the model, one based on potential theory and in the other, the tidal period is subdivided, and at each point of sub-division two surfaces are found which are best least-squares fits to the resolutions East and North of current magnitude. This is done by Fourier analysis. Two methods can be combined by applying Green's formula to the boundary data, and then adding the information gained in this way to the data already available for the least-square fit. Enough work has been done to provide strong evidence for the viability of the method. The programs are written in Fortran IV for an I.C.L. system 4-50. (Upadhyaya-Vanderbilt)
W70-10207

THE FLOW OF ROUND BUOYANT JETS ISSUING VERTICALLY INTO AMBIENT FLUID FLOWING IN A HORIZONTAL DIRECTION,
Waterloopkundig Laboratorium, Delft (Netherlands).
G. Abraham.
Fifth International Water Pollution Research Conference, San Francisco, July 26-Aug 1, 1970. Preprint, 7 p, 3 fig.

Descriptors: *Jets, *Velocity, Thermal pollution, Momentum equations.
Identifiers: *Buoyant jet, Entrainment, Drag coefficient, Drag force, Cross-flow.

Hot stack gases discharged into a cold cross-wind and jets of sewage issuing into an ocean-current are two examples of the phenomenon of a round buoyant jet into a cross-flow. In the present analysis a modification of Loh-Nien Fan's description of the entrainment is given. Describing the entrainment of round buoyant jets in a crossflow distinction must be made between a subdomain with predominant influence of buoyancy. Making this distinction the problem can be solved theoretically on basis of two separate coefficients of entrainment to express the entrainment in both subdomains and on basis of one drag coefficient to describe the drag force per unit length of jet, FD. The coefficient of entrainment for jets primarily influenced by initial momentum is taken as 0.057 and for thermals moving through stagnant ambient fluid, 0.5. The drag coefficient CD is taken as 0.3. Theoretical solutions obtained along this method were found to agree with experiments. (Upadhyaya-Vanderbilt)
W70-10209

MODELING SPREAD OF HEATED WATER OVER LAKE,
Minnesota Univ., Minneapolis. Dept. of Civil Engineering and Hydraulics.
Heinz Stefan.
Journal of the Power Division, Proceedings ASCE, Vol 96, No PO3, Proc Paper 7375, June 1970, p 469-482. 1 fig, 1 tab, 10 ref.

Descriptors: *Thermal pollution, *Cooling water, *Thermal powerplants, Environmental engineering, Hydraulic models, Lakes, Nuclear powerplants, Outlets, Reservoirs, Temperature, Water quality, Dispersion.

Physical modeling must include three significant phenomena, mixing at the outlet, stratification, and surface heat transfer. Flow and cooling of a warm water surface layer can be represented in a model if, first, flow of water in and out of the model, and, secondly, atmospheric conditions above the model are controllable. Because the cooling process follows an exponential law, 'all' may signify 95 percent to 99 percent. Using the dimensionless equations of motion, continuity and heat transfer, similarity criteria for the flow of heated water over an essentially stagnant and colder impoundment are presented. Turbulent flow in the model, matching of reduced gravitational forces and surface heat loss as well as sufficient size of the model are considered to be most essential modeling requirement. (Upadhyaya-Vanderbilt)
W70-10212

HYPERBOLIC COOLING TOWERS, DEVELOPMENT AND PRACTICE,
Rogers-Cohen-Barreto-Marchertas, Inc., Chicago, Ill.
Paul Rogers, and Eli W. Cohen.
Journal of the Power Division, Proceedings of ASCE, PO1, Proc Paper 7030, Jan 1970, p 117-128. 18 fig, 10 ref.

Descriptors: *Thermal pollution, *Cooling towers, *Winds, Pressure, Dead loads, Foundation.
Identifiers: *Hyperbolic cooling towers, Plexiglass model, Shells, Diagonal columns.

Mathematical studies leading to membrane analysis are briefly described. The total design of a hyperbolic cooling tower involves more than the shell analysis. It includes the other major steps such as the foundations, the diagonal columns, the lintel, and the top stiffening girder. Numerous tests and measurements indicate that positive pressure exists only on a relatively small portion of the tower at the windward side. Starting at about 40 deg azimuth, the rest of the shell is under negative pressure with maximum values at about 70 deg azimuth. Smooth surfaces are subject to substantially increased negative pressures. Tests indicate that there is virtually a uniform negative pressure within the tower with an approximate value of one-half of the wind force. Aerodynamical instability should be avoided. The model tests provided information concerning the distribution of wind forces, the meridian membrane and flexural forces, the parallel membrane and flexural forces. While earthquake design is not included herein, it is recommended that the provisions of the Structural Engineer's Association of California be employed with particular emphasis to ductility and dynamic response. It is concluded that the theoretical and practical development of hyperbolic cooling towers has reached a high plateau of efficiency. (Upadhyaya-Vanderbilt)
W70-10213

SALT-WATER COOLING TOWERS QUESTIONED.

Electrical World, June 1, 1970, p 46-47. 1 fig.

Descriptors: *Cooling towers, *Saline water, *Thermal pollution.
Identifiers: Material selection, Drift.

Several areas of technical concern with salt-water towers were reported. In addition to more obvious problems of material selection, marine growth in towers, vapor-plume dispersion, and hurricane-wind design, it was noted that the presence of salt in the cooling water acts to depress vapor pressure. This retards evaporation and causes a small increase in cooling-tower size for equal performance. Because salt is damaging both to metals and to vegetation, considerable effort was spent in trying to understand the mechanism by which it is transported and deposited. Towers now available, however, are said to limit drift to a maximum of 0.2% of tower-circulated water. Using this upper limit, and with designed circulation - water requirements at the ultimate 2,384-Mw Turkey Point rating, salt could be released to the atmosphere at up to 66,600 lb. per hour. Based on 7000 hr. per year of operation, this could accumulate to 466 million lb. per year. Fouling and corrosion of electrical switch gear and control equipment would cause serious operating and maintenance problems for the operating utility. (Upadhyaya-Vanderbilt)
W70-10221

ENVIRONMENTAL POLLUTION-A SELECTIVE BIBLIOGRAPHY.
Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. Information Services Section.
For primary bibliographic entry see Field 10.
W70-10228

A REVIEW OF THE 1969 LITERATURE ON WASTE WATER AND WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 1.
W70-10267

TOWN OF FRISCO CITY V GREEN (CITY'S BURDEN OF PLEADING COMPARATIVE INJURY DOCTRINE WHERE CITY'S SEWER POLLUTES BRANCH FLOWING THROUGH DAIRY).
For primary bibliographic entry see Field 06E.
W70-10303

TASK I REPORT: SURVEY OF LARGE-SCALE HEAT REJECTION EQUIPMENT,
Dynatech R/D Co., Cambridge, Mass. Thermal Engineering Group.
John H. Carey, John T. Ganley, and John S. Maulbetsch.
Federal Water Quality Administration, Water Pollution Control Research Series, July 1969. 127 p, 31 fig, 8 tab, 86 ref. FWQA Project 16130 DHS---7/69, Contract 14-12-477.

Descriptors: *Thermal power plants, *Cooling towers, Heat, Condensers, *Thermal pollution.
Identifiers: Cooling ponds, *Heat rejection equipment.

Various types of heat transfer equipment which would be applicable to the task of dissipating condenser discharge heat from large power plants are identified. Their performance is analyzed, performance prediction methods are presented, and

the capital and operating costs are given. A brief review was made of the basic thermodynamics of the Rankine power cycle in order to provide some basis for understanding the effect of the heat rejection process on the total cycle. Information including sizing procedures, capital and operating costs, duty maintenance requirements, and possible secondary pollution considerations are presented for candidate systems such as once-through cooling (to serve as a base), cooling ponds, spray ponds, wet cooling towers, dry cooling towers, evaporation condensers, and air-cooled condensers. Operational considerations are discussed including the theory of operation at the design point, off-design performance, running procedures, and any unusual characteristics affecting the interface between the cooling system and the power plant. The material describing each of the individual units is integrated and procedures and criteria are developed for the selection of an optimum unit given a particular geographic location, capacity requirements, and economic constraints. (See also W70-10316) (Maulbetsch-Dynatech)
W70-10315

TASK II REPORT: SURVEY OF POWER PLANT OPERATING CHARACTERISTICS AND DESIGN CRITERIA,
Dynatech R/D Co., Cambridge, Mass. Thermal Engineering Group.
Ware D. Fuller, and John S. Maulbetsch.
Federal Water Quality Administration, Water Pollution Control Research Series, August 1970. 94 p, 30 fig, 15 tab, 139 ref. FWQA Project 16130 DHS--8/70, Contract 14-12-477.

Descriptors: *Electric power production, *Thermal power plants, *Nuclear power plants, Heated water, Fuels, Operating cost, Maintenance costs, Heat exchangers, Temperature, *Thermal pollution.
Identifiers: Broiler plant, Steam turbines, Steam condensers, Fixed charge rate.

This report is part of a larger study to perform a technical and economic survey of alternate methods for cooling condenser discharge water from thermal power plants. The task reported on in this document investigates the criteria by which the power plants themselves are designed and optimized. These criteria are both technological and economic. The initial section reviews the general aspects of power plant selection. These include questions such as how the procedure of procuring a new plant is initiated, how the plant size is determined, what factors influence the choice of fuel and site location, and how the plant capacity factor and fixed charge rate are calculated. There follows a detailed review of design and cost optimization procedures. This includes a review of capital costs for the turbine-generator units and for the boilers. Operating costs are computed based on constant incremental running rates. A worked example is presented and carried to the point of a 'present worth' evaluation. A brief discussion of the use of feed-water heaters, single- and multi-pressure condensers is provided. Some operational considerations including instrumentation and control and plant layout are discussed briefly. A separately bound Appendix includes a Heat Rate Table for General Electric turbines, and Westinghouse and General Electric price lists for both conventional and nuclear turbine-generator units. (See also W70-10315) (Maulbetsch-Dynatech)
W70-10316

CITY OF CLANTON V JOHNSON (ABATABLE NUISANCE AS CONSTITUTED BY NEGLIGENT MAINTENANCE OF SEWERAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W70-10330

DOUCET V TEXAS CO (RELATIVE RIGHTS OF MINERAL LESSEES AND OYSTER LESSEES).
For primary bibliographic entry see Field 06E.
W70-10353

ENFORCEMENT LIMITATIONS IN WATER QUALITY CONTROL,
Federal Water Quality Administration, Washington, D.C.
Murray Stein.
Water Resources Bulletin, Vol 6, No 4, p 473-475, July-August, 1970.

Descriptors: *Water quality control, *Limiting factors, Jurisdiction, Water Quality Act, Public health, Legislation, Water policy, Navigable waters.
Identifiers: *Enforcement.

The Federal role in enforcement of water quality requirements began with the enactment in 1956 of the Federal Water Pollution Control Act. It has been expanded by successive amendments to the act to cover the pollution of navigable as well as interstate water which endangers the health or welfare of persons, and to cover violations of water quality standards established for interstate waters. Two different enforcement procedures are prescribed in the law to be followed in the two types of enforcement actions. While questions have arisen of jurisdiction, state's rights, and disregard or duplication of local efforts, such questions do not lastingly impede the exercise of Federal enforcement authority in the Statutory distinctions between interstate and intrastate pollution which govern the application of the enforcement authority, even though a case of intrastatepollution may be as serious or more serious than a case of interstate pollution. An additional limitation, results from the statutory time intervals between procedural stages in an action. Lack of data is a limitation but can always be overcome. State laws which protect the confidentiality of required reports are also a limitation. Investigative teams may obtain the needed information, however, for consideration in public meetings. Public support for effective water quality control measures, especially enforcement, and for the expenditures needed to enhance the environment, is widespread. Such support may be instrumental in modifying or eliminating existing statutory limitations. (Mariott-Chicago)
W70-10354

LAKE MICHIGAN SHORE WATER QUALITY SURVEY 1969, REPORT TO THE GOVERNOR AND THE 76TH GENERAL ASSEMBLY.
Illinois State Sanitary Water Board, Springfield.

Illinois State Sanitary Water Board, Report to 76th General Assembly, May 1970, p 31. 3 tab, 14 fig.

Descriptors: *Water quality, *Lake Michigan, *Illinois, *Water pollution, *Beaches, Turbidity, Phosphates, Bacteria, Coliforms, Water pollution sources, Plankton, Eutrophication.
Identifiers: Lake County, Cook County, Chicago.

The results of shore water monitoring showed bacteria, turbidity, floating debris,phosphates, and ammonia nitrogen counts in 1969 substantially higher than in 1968. It is hypothesized that a 50% increase in rainfall over the year contributed to this rise by causing the Metropolitan Sanitary District to allow backflow of polluted river water into Lake Michigan. On the North shore, where beach closings were numerous and where sewage treatment plants discharge into the Lake instead of the river watershed, many plants provide only primary treatment: all are operating in excess of their design capacities. The North Shore Sanitary District is constructing new facilities which will discharge a high quality effluent into the Illinois River watershed. The MSD is developing a program to resolve its drainage problem. While adequate standards and authority to control pollutional discharges exists, new legislation is needed to assist in the implementation of plans and needed pollution control facilities. Plankton counts, an indicator of lake eutrophication, were less than half the magnitude of the 1968 averages. (Wexman-Chicago)
W70-10360

ESTUARINE CLEAN WATER COST-BENEFIT STUDIES,
International Water Pollution Research Conference (5th).
R. Stone, and H. Friedland.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper III-17. 8 p, 8 tab.

Descriptors: *Benefits, *Economics, *Evaluation, *Cost-benefit analysis, *Social aspects, Intangible benefits, Intangible costs, Social values costs, Value.
Identifiers: *Socio-economic values.

A socio-economic analysis was made of the beneficial uses of San Diego Bay in relationship to the improvement of the Bay's water quality following diversion of sewage from the bay to the Pacific Ocean in 1963. An initial approach based upon land values found that areas within 8 miles of the bay increased 27% more than land values of a zone up to 15 miles more distant. Approximate costs are tabulated of several alternatives including three degrees of treatment and diversion of effluents to the ocean. Economic benefits are stated for various recreational uses with alternative treatment programs. (No basis is given for these benefits). An 'algorithm' was derived to evaluate intangible social costs and benefits. This consists of mean weighting of social values on a non-monetary scale by a number of individuals, and the further assumption that the social intangibles thus evaluated should be given a monetary value of 60, 80 or 100% of the over all economic benefits. With these socio-economic values and various assumptions, optimum courses of action were derived. (Whipple-Rutgers)
W70-10373

PHYSIOCHEMICAL AND MICROBIOLOGICAL PROPERTIES OF URBAN STORM WATER RUNOFF,
Swedish Inst. for Surface Chemistry.
G. Soderlund, H. Lehtinen, and S. Friberg.
Fifth International Water Pollution Research Conference, San Francisco, July 26-August 1, 1970. Preprint, Paper I-2. 8 p, 18 fig.

Descriptors: *Storm runoff, *Chemical properties, *Microbiology, Sampling, Physical properties, Runoff, Nitrogen, Coliforms, Biochemical oxygen demand, Phosphorus, Water pollution effects.
Identifiers: Urban runoff, Lead, Suspended solids, Volatile solids, Sweden.

In Sweden today a separation of storm and sanitary sewers is usually preferred. This avoids the discharging of mixed storm water and waste water into the streams and inland waters. There is an increasing discussion as to whether the direct discharge of storm water into streams can be justified for the future. A study to collect more information concerning the nature and extent of the pollutional load from highly urbanized areas was made. The results of this study showed that the discharging of snow melt from heavily trafficed areas into streams and inland waters contributes in a great extent to the pollution of the recipients with oil and heavy metals. Traffic roads give a high degree of contamination as compared with the other test areas. The oil in the storm water is contaminated with oil not only from the traffic but also an unexpectedly great extent from other areas, especially the industrial areas. As the use of cutting oils and emulsions, dry cleaning liquids and industrial cleaning liquids is still increasing, since the problem of collection and destroying such waste liquids must be solved. The various measurements were taken in very different areas with respect to traffic intensity. The analytical values obtained represent a skewed distribution. Nearly 50% of the dry residue obtained from warm water runoff is volatile material, probably asphalt from the roadway, rubber from tires and oil. Other constituents measured in concentration versus time were chloride, pH, nitrogen, phosphorus, coliforms, carbohydrates, and BOD. (Hancuff-Texas)
W70-10398

THE EXTENT OF NITROGEN AND PHOSPHORUS REGENERATION FROM DECOMPOSING ALGAE,
Kentucky Univ., Lexington. Dept. of Civil Engineering; Texas Univ., Austin. Dept. of Civil Engineering; and Stanford Univ., Calif. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 05C.
W70-10405

UNITED STATES V ALASKA'S PACKING CO (PROSECUTION FOR OIL POLLUTION).
For primary bibliographic entry see Field 06E.
W70-10438

LIVEZEY V TOWN OF BEL AIR (DUTY OF MUNICIPALITY TO OPERATE ITS SEWAGE DISPOSAL PLANT IN SUCH A WAY AS NOT TO CREATE A NUISANCE).
For primary bibliographic entry see Field 06E.
W70-10441

THE PANAM (LIBEL FOR THE DISCHARGE OF OIL INTO COASTAL NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W70-10442

NELSON V TOWN OF NORTHUMBERLAND (TOWN'S RESPONSIBILITY TO MAINTAIN SEWERS PROPERLY).
For primary bibliographic entry see Field 06E.
W70-10445

THE SS NEA HELLIS (VIOLATION OF OIL POLLUTION ACT).
For primary bibliographic entry see Field 06E.
W70-10461

DOLLAR SS CO V UNITED STATES (DISCHARGE OF REFUSE INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 05B.
W70-10462

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

LEAST SQUARES ESTIMATION OF CONSTANTS IN A LINEAR RECESSION MODEL,
Kentucky Univ., Lexington.
L. Douglas James, and William O. Thompson.
Water Resources Research, Vol 6, No 4, p 1062-1069, August 1970. 8 p, 2 tab, 12 ref. OWRR Project A-001-KY.

Descriptors: *Statistical methods, *Data collections, *Recession curves, Gaging stations, *Streamflow forecasting, *Hydrologic data, Least squares method, Regression analysis, Base flow, Hydrograph analysis, Runoff forecasting, Model studies, Mathematical models.
Identifiers: Streamflow recession.

Least squares can be used for estimating constants in a linear recession model from published average daily streamflows. A model with two recession constants was derived and successfully tested on a number of Kentucky streams. It can be used to estimate recession constants from daily streamflows stored on magnetic tape or punched cards without resorting to time-consuming graphical techniques. Equations and procedures are provided for recessions represented by either one or two recession constants using both a weighted and unweighted estimation procedure. In applying the two techniques, empirical evidence indicates the simpler unweighted procedure is preferable. (Knapp-USGS)
W70-10052

OPTIMAL PLANNING OF A COASTAL COLLECTOR,
Technion-Israel Inst. of Tech., Haifa; and Water Planning for Israel Ltd., Tel-aviv.
For primary bibliographic entry see Field 02F.
W70-10053

LINEAR DECISION RULE IN RESERVOIR MANAGEMENT AND DESIGN 2. PERFORMANCE OPTIMIZATION,
Cornell Univ., Ithaca, N.Y.; and Geological Survey, Arlington, Va.
Charles ReVelle, and William Kirby.
Water Resources Research, Vol 6, No 4, p 1033-1044, August 1970. 12 p, 6 fig, 2 tab, 3 ref.

Descriptors: *Decision making, *Linear programming, *Reservoir design, *Reservoir operation, *Optimization, Water yield, Reservoir yield, Mathematical models, Water management (Applied), Water storage, Evaporation, Water yield improvement, Stochastic processes.
Identifiers: Reservoir yield optimization, Reservoir management.

The application of linear decision rules to reservoir management and design is extended in two directions. First, an improved linear decision rule is derived for reservoirs suffering evaporation losses. Release commitments generated by this rule are based on the storage at the beginning of the period, the predicted evaporation depth in the period, and the linearized storage area curve of the reservoir. A clearer and more rigorous derivation of the chance constraints, including the effects of both evaporation losses and possible failures to meet previous commitments, is presented. Second, several reservoir performance measures are formulated as objective functions that can be optimized linear programing. These performance measure include expected and reliable values of storages and releases, deviations from targets, and reliabilities of achieving stated goals. (Knapp-USGS)
W70-10054

LINEAR PROGRAMMING MODELS FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque.
For primary bibliographic entry see Field 06D.
W70-10055

VALUE OF STREAMFLOW DATA FOR PROJECT DESIGN-A PILOT STUDY,
Geological Survey, Fort Collins, Colo.; Colorado State Univ., Fort Collins; Corps of Engineers, Sacramento, Calif; and Geological Survey, Washington, D.C. Hydrologic Systems Lab.
For primary bibliographic entry see Field 02E.
W70-10056

APPLICATION OF LINEAR RANDOM MODELS TO FOUR ANNUAL STREAMFLOW SERIES,
Alaska Univ., College; and Wisconsin Univ., Madison.
For primary bibliographic entry see Field 02A.
W70-10069

SIMULATION-DECISION AID IN PLANNING DESALTING APPLICATIONS,
Office of Saline Water, Washington, D.C.
For primary bibliographic entry see Field 03A.
W70-10075

SIMULATION OF SPATIAL AND TEMPORAL CHANGES IN WATER QUALITY WITHIN A HYDROLOGIC UNIT,
Montana State Univ., Bozeman. Dept. of Civil Engineering; and Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 05G.
W70-10077

THE OPTIMIZATION OF THE OPERATION O A MULTI-PURPOSE WATER RESOURC SYSTEM,
Federal Water Quality Administration, Washin ton, D.C.; Virginia Polytechnic Inst., Blacksbu Dept. of Civil Engineering; and Water Resourc Engineers, Inc., Walnut Creek, Calif.
William N. Fitch, Paul H. King, and George K. Young, Jr.
Water Resources Bulletin, Vol 6, No 4, p 498-51 July-August 1970. 21 p, 6 fig, 13 tab, 10 ref.

Descriptors: *Systems analysis, *Optimizatio *Water resources development, Reservoir desig Reservoir operation, Water management (A plied), Computer programs, Planning, Watersh management, River basin development.
Identifiers: Water resource optimization.

The objective of any water resource system is transform the natural waters of a river basin into form such that optimal use of these waters w result. Thus the water may be transformed in electrical energy, transferred in space for wat supply and irrigation, transferred in time for flo control and maintenance of adequate streamflow or simply retained for use as a means for achievi waterbased recreation. This paper discusses means for determining how a given system shou be operated to maximize the net benefits. An exa ple of the type of tradeoff which occurs in such system is the conflict between power generati and flow augmentation. The answer to the trade problem can be found by utilizing the systems a proach. An algorithm is presented which optimiz the performance of a system in the context of t objective. The technique is applied to a basin to lustrate the type of answer that results from the a plication of the model. The optimization of a wat resource system consisting of three multi-purpo reservoirs and five waste treatment faciliti required 2.4 minutes of IBM 360/65 time. T system had 42 possible combinations of reserv levels. The computer time would increase appro mately in proportion to the square of the number possible combinations of reservoir levels. (Knap USGS)
W70-10078

SYSTEMS ANALYSIS OF WATER SUPPI SYSTEMS,
Michigan Univ., Ann Arbor.
Rolf A. Deininger.
Water Resources Bulletin, Vol 6, No 4, p 573-57 July-August, 1970. 7 p, 2 fig.

Descriptors: *Water resources developme *Systems analysis, *Optimization, *Groundwat Water management (Applied), Design, Plannir Water supply, Mathematical models, Networl Network design, Water costs, Water yield.
Identifiers: Ankara (Turkey), Groundwat resources.

Systems analysis and operations resear techniques may be used for the planning, desi and operation of specific parts of a water supp system. Optimal design and development groundwater sources, particularly the operation well fields and regional development of futu supply sources are described. The question which supplies should be developed, at what tim to what degree, and which transmission lin should be built to minimize the costs of regio water supply, are formulated mathematically. (napp-USGS)
W70-10080

A CRITERION FOR INVESTING IN INFORM TION,
New York Univ., N.Y.
Joel Owen.
Management Science: Application, Vol 14, No Aug 1968, p B715-B720. 6 p, 2 ref.

Descriptors: *Decision making, Risks, Costs, Da Investment.
Identifiers: Decision theory.

In numerous water resources planning situations, decisions must be made based on incomplete information. A procedure by which the decision maker can choose between two courses of action; one, to make a decision based on existing information or two, to institute a study program i.e., to invest in information before making a decision, was developed. Both choices involved risk and depended on the cost of analyzing data, the number of people involved and the value of the information gathered. Decision Theory provided a framework for the view adopted. The risks involved in the binary decision problem was defined explicitly. A model and assumptions were presented. The risk of immediate decision whereby the decision maker uses his own judgment was described. The risk of investing in information was also given. The risk or opportunity loss including the price of the study was computed and compared with the risk of immediate decision. As an aid to the decision maker unfamiliar with the specifics of the theory, answering a series of questions will allow him to determine the parameter values to be used in reaching the minimum risk action. An example was presented to illustrate the decision procedure. Comments were offered on the general use of the risk comparison concept used. (Kriss-Cornell)
W70-10151

FUNDAMENTAL ISSUES IN THE SIMULATION OF HUMAN BEHAVIOR: A CASE STUDY IN THE STRATEGY OF BEHAVIORAL SCIENCE,
Pittsburgh Univ., Pa. Graduate School of Business.
Ian I Mitroff.
Management Science: Application, Vol 15, No 12, Aug 1969, p B-635-B-649. 15 p, 34 ref.

Descriptors: *Simulation analysis, *Computers, Data, Analytical techniques, Model studies, Testing, Behavior.
Identifiers: Turing's test.

A report was presented on selected aspects of the actual growth and development of a simulation project, especially as the process affected the development of a novel method for validating simulation models. A philosophical analysis of the concept of simulation, especially as the analysis formed an integral part of the study's development was also given. The paper's main thesis was that the teleology or purpose behind the construction of the simulation model was an ever present taskmaster guiding and influencing all the phases of the model's construction and validation. One such test for validation of the model mentioned is Turing's test based on the notion of an 'imitation game'. The question asked during any test of validation were said to be the same at every level: 'What are we testing, the data or the theory by which the data was collected.' The two basic approaches to reality that investigators of simulation assume, labeled rationalism and empiricism, were discussed. Experimentalism and Man-Machine Dialectics were also described in detail. This paper has application to water resources simulation model studies in which decision makers are required to interact with the model. (Kriss-Cornell)
W70-10152

CAPACITY EXPANSION FOR INDIA'S NITROGENOUS FERTILIZER INDUSTRY,
Agency for International Development, Washington, D. C.
Donald Erlenkotter, and Alan S. Manne.
Management Science: Application, Vol 14, No 10, June 1968, p B553-B572. 20 p, 2 fig, 10 tab, 3 ref, 1 append.

Descriptors: *Project planning, *Decision making, Investments, *Demand, Chemicals, Fertilizers, *Optimum development plans, *Economies of scale, Costs, *Computer models.
Identifiers: *India.

A preinvestment survey for a massive investment program under way to meet increased demand for chemical fertilizers in India was presented. It intended to provide a rough framework within which to draw up a detailed proposal on the next few units for the chemical fertilizer industry built. The initial premises for a specific project were: when, where, and how large a plant to construct. The problem of optimal plant size centered about the fact of economies-of-scale in investment costs. An attempt was made to calculate the size, location and time-phasing for nitrogenous fertilizer capacity so as to minimize the discounted costs of satisfying future demands. Cost comparisons were made between alternative configurations of plant size and time-phasing for six refinery-oriented producing locations. A constant cycle model, rather than dynamic programming, was used to make the comparisons. An over-all cost comparison between two plant sizes was obtained through use of the basic parameter values. A static location model for 1974 was designed as a conventional type. Computer results for the model were summarized. The appendix gave the derivation of the formula extending the costs for a two-location two-phase cycle plant size model to n locations with equal increments of demand growth and identical inter-area shipping charges. (Kriss-Cornell)
W70-10153

SEPARABLE MARKOVIAN DECISION PROBLEMS,
Rand Corp.
Eric V. Denardo.
Management Science: Theory, Vol 14, No 7, March 1968, p 451-462. 12 p, 1 fig, 14 ref.

Descriptors: *Markov processes, *Decision making, *Optimization, Model studies.

Numerous water resources optimization and simulation models are based on a Markov process. The special structure of a class of Markovian decision problems was exploited to simplify the determination of optimum policies. A Markov renewal programming model was first reviewed. The special structure of Problem I was exploited in two closely interrelated ways: a streamlined Markovian decision problem called Problem II was identified and shown to be equivalent to Problem I; and Problem I was analyzed in a manner which accounted in part for the streamlining in Problem II. Two examples of separable Markovian decision processes provided illustrations of notational devices and indicated the breadth of the class of separable problems. Streamlined approaches were presented for dealing directly with the original problem and the particular inventory model example was further simplified. (Kriss-Cornell)
W70-10154

ON AN ALGORITHM FOR THE SOLUTION OF MIXED INTEGER PROGRAMMING PROBLEMS,
State Univ. of New York, Buffalo.
Stanley Zionts.
Management Science: Theory, Vol 15, No 1, Sept 1968, p 113-116. 4 p, 5 ref.

Descriptors: *Optimization, *Program, Variability.
Identifiers: Algorithm, Mixed integer programming.

A variety of mixed integer programming models have been proposed for the solution of water resources problems. Details of the author's suggestion for more compact representation of integer constraints in an algorithm for the solution of Mixed Integer Programming Problems referred to in an article by Norman J. Driebeek (Management Science, March 1966) was given. Familiarity with Driebeek's paper was assumed for the presentation. Driebeek represented an integer variable as a sum of a set of zero-one variables. Changes were made to Driebeek's algorithm and were summarized as follows: (1) Solve for the noninteger optimal. If integer halt; (2) compute the penalties as in the original paper; (3) choose a trial solution based on the penalties and proceed to it by introducing variables into the basis that are to be basic in that trial solution; (4) if a feasible integer solution is found, it should be noted and used to determine whether any further solutions need be tested as in Driebeek's algorithm. An optimal solution to the example of Driebeek, using the alteration to Driebeek's method was presented. (Kriss-Cornell)
W70-10155

STOCHASTIC SENSITIVITY ANALYSIS OF MAXIMUM FLOW AND SHORTEST ROUTE NETWORKS,
Rand Corp.
Richard D. Wollmer.
Management Science: Theory, Vol 14, No 9, May 1968, p 551-564. 14 p, 17 ref.

Descriptors: *Stochastic processes, Routing, Analytical techniques, Variability.
Identifiers: Algorithm, Maximum flow, Sensitivity problems, Max-flow Min-cut theorem.

An algorithm used to solve two types of network sensitivity problems was presented. In the first, arcs were subject to breakdowns that degrade their capacities. An undirected source-sink planar maximum flow network was given in which each arc was subject to anywhere from 0 to n breakdowns. It was required to find the maximum possible effect of n breakdowns on maximum flow. In the second, arcs were subject to improvements that reduced their lengths. A shortest route network was given in which each arc was subject to anywhere from 0 to n improvements. It was required to find the maximum possible effect n total improvements can have on shortest path length. Capacities resulting from breakdowns and lengths resulting from improvements were random variables specified by their mean values and variances. The central idea in solving of maximum flow network problems was summarized in the max-flow min-cut theorem. Justification for the algorithm used was described in detail. The algorithm would be practical provided the number of labels in each set remained small. (Kriss-Cornell)
W70-10157

DISCRETE STOCHASTIC PROGRAMMING,
California Univ., Davis.
K. D. Cocks.
Giannini Foundation Paper 282. Management Science: Theory, Vol 15, No 1, Sept 1968, p 72-79. 8 p, 4 tab, 8 ref.

Descriptors: *Linear programming, *Stochastic processes, Mathematical models, Variability, Constraints.
Identifiers: *Multistage problems, Passive programming, Active programming.

A method for solving water resources and other linear programming problems where (any number of) the functional, restraint, and input-output coefficients were subject to discrete probability distribution, was presented. The objective function was formulated in terms of variance and/or expectation. The method of stochastic programming presented was devised primarily to deal with multistage problems but, to demonstrate flexibility, the general explanation was in terms of an active programming approach and examples and a heuristic discussion was used to bring out the multistage possibilities. Initially, the prior allocation which maximizes expectation was derived and then the model was quadraticized for maximizing a function of expectation and variance or for deriving the E-V efficient set. The procedure involved the simultaneous generation of all (mutually exclusive) possible outcomes and hence the transference of all variability into the objective function of a very much enlarged linear program. This was a 'constrained passive programming' or 'constrained active programming' technique, at least in multistage applications. (Kriss-Cornell)
W70-10158

SYSTEMS OF DEMAND EQUATIONS: AN EMPIRICAL COMPARISON OF ALTERNATIVE FUNCTIONAL FORMS,
Chicago Univ., Ill.
Richard W. Parks.
Econometrica, Vol 37, No 4, p 629-650, October 1969. 8 tab, 30 ref.

Descriptors: *Demand, Statistical methods, Estimating.
Identifiers: *Indirect addilog system, *Linear expenditure system, *Differential logarithmic system, Demand equations, Consumer demand, Econometrics, Specification, Parameters.

A variety of complete systems of demand equations have been proposed for econometric use. These systems give strong allegiance to classical demand theory, and most introduce restrictions in order to simplify the model and reduce the number of parameters. Theoretically, however, none of the models dominates its competition. The choice of specification for empirical work must then be made on an empirical basis: which model performs best. This paper considers three demand models: the indirect addilog system, the linear expenditure system, and the differential logarithmic system. The paper provides a comparison of the models in terms of both their theoretical properties and their empirical usefulness. Section 2 of the paper compares the models in terms of their theoretical properties. Section 3 presents the empirical results for the models, the parameter estimates, and certain test statistics that are used to compare the empirical validity of the models. Section 4 introduces certain auxiliary statistics that allow a detailed comparison of the model's performance. This article provides a comprehensive review of factors to consider when estimating water demand equations and should be of value to research concerned with water demand estimation. (Loeb-Rutgers)
W70-10194

MEKONG DELTA MATHEMATICAL MODEL PROGRAM CONSTRUCTION,
Bologna Univ. (Italy); and Societe Grenobloise d'Etude et d'Applications Hydrauliques (France).
For primary bibliographic entry see Field 04A.
W70-10264

ANALYSIS TECHNIQUES FOR HOUSTON SHIP CHANNEL,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W70-10266

AN ECONOMIC MODEL FOR A POLLUTED RIVER SYSTEM,
For primary bibliographic entry see Field 05B.
W70-10370

WATER QUALITY AND MANAGEMENT EXPERIENCES OF THE DELAWARE RIVER BASIN COMMISSION,
Delaware River Basin Commission, Trenton, N.J.
For primary bibliographic entry see Field 05B.
W70-10371

THE APPLICATION OF A LINEAR PROGRAMME MODEL TO WATER CONSERVATION AND EFFLUENT MANAGEMENT AT MODDERFONTEIN FACTORY,
African Explosives and Chemical Industries Ltd., Johannesburg (South Africa); and National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 05D.
W70-10374

6B. Evaluation Process

WATER IN URBAN PLANNING, SALT CREEK BASIN, ILLINOIS--WATER MANAGEMENT AS RELATED TO ALTERNATIVE LAND-USE PRACTICES,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04C.
W70-10070

COMMUNITY LEADERSHIP AND WATERSHED DEVELOPMENT,
Mississippi State Univ., State College. Water Resources Research Inst.
K. P. Wilkinson, and R. N. Singh.
Available from NTIS as PB-194 455, $3.00 in paper copy, $0.65 in microfiche. Completion Report, Mississippi Water Resources Research Institute, August, 1970. 62 p, 13 tab. OWRR Project A-035-MISS (1).

Descriptors: Behavior, *Watershed management, Psychological aspects, Social aspects, *Social participation.

This study was intended to assess correlates of levels of involvement of local community leaders in small watershed projects under P. L. 566. Three key actors in each of eleven completed watershed projects in Mississippi were interviewed in depth to identify actors, associations and activities. A survey was then conducted in each watershed of those persons most frequently named as having been significant actors. Detailed interview schedules were completed on 114 actors. The principal measure of the dependent variable consisted of a profile of the actor's performance of the discrete roles which had been identified through interviews with key informants. A high level of intercorrelation of this with seven alternative measures was found. Bivariate analysis gave substantial support to the general hypothesis that intensity of participation in a watershed project is related to generality of commitment to and participation in community action. Also found was a relationship between participation in the watershed project and probability of personal, economic benefit.
W70-10114

PHYSICAL AND ECONOMIC FACTORS ASSOCIATED WITH THE ESTABLISHMENT OF STREAM WATER QUALITY STANDARDS, VOLUME II,
Iowa State Univ., Ames. Engineering Research Inst.
For primary bibliographic entry see Field 05G.
W70-10123

THE ENGINEERING AND MANAGEMENT OF AN EFFECTIVE SYSTEM,
International Systems Co.
Donald S. Feigenbaum.
Management Science: Application, Vol 14, No 12, Aug 1968, p B-721-B-730. 10 p.

Descriptors: *Management, Engineering, Systems analysis, Design, Programs, Costs.

A review of engineering and management of truly effective systems with a consideration of the form taken by the systems concept today was presented. The general operational form that the concept takes was readily stated where the key to the approach of modern systems engineering, including water resources systems engineering, is that changes in equipment and manpower content; in interrelationship structure; in information flow; and in management and control of these systems must be accomplished not only in terms of their own improvement but in terms of their impact on total effectiveness. Four system characteristics were of interest: (1) systems structures have become extended, intricate, and involved; (2) the more traditional manpower, machine and information elements have been replaced and upgraded by more complex and intricate production equi ments, data processing setups and specializ professionals; (3) the economics of improveme planning has too often been based on the self ins lated cost islands of traditional bookkeeping; a (4) the total systems structures often are not und direct management and engineering control of t company. Systems management, used to integra scientific, behavioral and mathematical disciple was described. (Kriss-Cornell)
W70-10156

RURAL-URBAN DIFFERENCES REFLECTE IN OUTDOOR RECREATION PARTICIPATIO
Forest Service (USDA)., Seattle, Wash.
John L. Hendee.
Journal of Leisure Research Vol 1, No 4, p 33 341, Autumn 1969.

Descriptors: *Outdoor recreation, *Motivatio *Use rate, Social aspects, Rural sociology, Urb sociology, Population, Values, Environment, E ployment, Recreation demand, Economic impa Transportation.
Identifiers: *Residence participation, Populati density, Cultural differences, Familiarity.

It is pointed out that in many studies of outdo recreation residence is an important variable. T is true in studies of water recreation where ru and urban participation differences are usually sumed. The paper examines several theories th seek to explain this condition and finds them to cast in general, ambiguous terms and difficult test empirically. Many methodological proble must be overcome and the traditional lack of rig characteristic of recreation studies, eliminated. N tional surveys have found economic and soc states, and age to be more important than residen in recreation participation so that theories based the latter are apt to be misleading. Future theori should be built around more theoretically justifi ble factors. (Murphy-Rutgers)
W70-10187

THE THEORY OF PRICE DETERMINATION GOVERNMENT-INDUSTRY RELATIONSHIPS
Louisiana State Univ., New Orleans; and Oh Univ., Athens.
A. M. Agapos, and Paul R. Dunlap.
Quarterly Journal of Economics, Vol LXXXIV, N 1, p 85-99, February 1970. 7 fig.

Descriptors: *Governments, *Prices, *Monopo Industries, Profit, Costs, Procurement, Contrac Political aspects, Employment, Legal aspects.
Identifiers: *Price determination, *Monopso *Bilateral monopoly, Output, Industrial capacity.

There have been attempts to explain monopoli monopsonist environments through vario techniques where the established objectives of t parties are considered to be inconsistent and determinate. Generally, in an exchange confined two parties, it is assumed that the one with greatest bargaining power will theoretically dict the outcome. The usual approach of explaini government operations with industry is the conce of bilateral monopoly, where the government is monopsonist and the contracting firm is monopolist. The prevailing explanation is that contractor seeks to maximize profits and government tries to minimize costs. However, t explanation is shown to be inadequate and hind the understanding of the government-industry re tionship. This paper explains how a governmen single source contract is different from the conve tional bilateral monopoly and then develops mathematical model for this government-indus relationship. A more general model is provided multisource procurements. A general mathema cal model covering all government-industry re tionship is supplied. As such, this is useful in water area where government may be the s buyer of a water resource or contractor for work water resource projects. (Loeb-Rutgers)
W70-10188

HE EFFECTIVENESS OF REGULATION OF LECTRIC UTILITY PRICES,
lichigan State Univ., East Lansing.
homas Gale Moore.
outhern Economic Journal, Vol 36, No 4, p 365-75, April 1970. 2 tab, 9 ref.

escriptors: *Regulation, *Electricity, *Prices, rofit, Demand, Marginal costs, Estimating, Costs, onstraints.
lentifiers: *Electric utility prices, Electric utilities, larginal revenue.

he objective of this study is to measure the effecveness of the regulatory process in reducing rices to residential users of electrical utilities. In it, e marginal cost for 62 private electric companies nd 7 municipal ones are computed and the deand curves facing them are estimated. From these nctions, the profit-maximizing prices, p sub m, re estimated and compared with the actual prices harged to indicate the effectiveness of regulation. hort run marginal cost is estimated using Federal ower Commission cross sectional data on produon costs for steam plants. Demand is estimated om cross sectional statistics on residential conmption, electricity prices, and natural gas prices. olving for the profit maximizing price by setting e marginal revenue function equal to marginal osts indicates that regulation has reduced prices nly slightly on average for the Investor Owned tilities. Municipal power companies, however, harge considerably less than the profit maximizing rice. This methodology may prove applicable to e water area when attempting to measure the efctiveness of regulation in reducing prices for the se of water supply facilities. (Loeb-Rutgers)
/70-10189

HE EXISTENCE OF AGGREGATE PRODUCION FUNCTIONS,
lassachusetts Inst. of Tech., Cambridge.
ranklin M. Fisher.
conometrica, Vol 37, No 4, p 553-577, October 969. 28 ref.

escriptors: *Aggregates, Labor, Capital.
lentifiers: *Aggregate production function, Effiiency, Capital aggregation, Production function, abor aggregation, Output aggregation, Approxiation, Fixed capital.

he estimation and use of aggregate production nctions has become a widespread and important ractice in economic analysis. Such uses fall into wo main classes. On the one hand there has been ajor efforts in the estimation of aggregate producon functions for entire economies, for manufacuring, for durables, etc. These papers have made mpirically derived inferences about the imortance of technical change; about the rate of eturn to investment, social or private; about the hare of wages in national product; and, generally, bout the technical and economic forces making or growth. On the other hand, aggregate producon functions have been used to represent technial possibilities of an economy in which some interemporal welfare function is maximized or as a asic constituent of a one or two-sector descriptive rowth model. In both problems, the use of an aggregate relatonship between an output aggregate nd constructs called 'labor' and 'capital' is a conenience. The author examines the circumstances nder which technological relationships can be ubsumed in an aggregate form and discusses the nferences from such a model and its approximaon to the real world. This article would be relevant to the empirical studies of water production nctions. (Loeb-Rutgers)
/70-10190

STIMATION OF JOINT PRODUCTION FUNCTIONS,
ennsylvania Univ., Philadelphia; and Stanford Jniv., Calif.
. J. Dhrymes, and B. M. Mitchell.
conometrica, Vol 37, No 4, p 732-736, October 969. 1 tab, 1 ref.

Descriptors: Economics, Estimating, Least squares method.
Identifiers: *Estimation, *Joint production function, Canonical correlation.

In a recent paper, H D Vinod has suggested canonical correlation analysis as a technique of consistently estimating the parameters of joint production functions. While it is not clear that he intended this technique to be applicable to all possible specifications of such functions, it is presumably applicable at least to the explicity formulation he considers. In this note the authors show several things: first, Vinod's formulation contains an error; second, in the case p—q, canonical and ordinary least squares analyses are equivalent; third, if p does not equal q, then the canonical estimators cannot be consistent unless OLS estimators are as well. This paper may prove applicable to the water area in cases where econometric methods are used to estimate relations in the form of a joint production function. (Loeb-Rutgers)
W70-10191

THE COST OF CAPITAL AND INVESTMENT CRITERIA IN THE PUBLIC SECTOR,
Lehigh Univ., Bethlehem, Pa.
Eli Schwartz.
The Journal of Finance Vol XXV, No 1, p 135-142, March 1970.

Descriptors: *Capital, *Costs, *Government, *Investment, Economic evaluation, Interest rate, Discount rate, Optimization, Risk, Benefits, Taxes, Income, Debt, Prices, Profit, Economic efficiency.
Identifiers: *Pareto optimum, *Present value, Social time preference, Social benefit, Rate of return.

There has been considerable controversy regarding the problem of government investment under the assumption that biases against government spending, frictions in the capital market, and a systematic divergence between the non-risk interest rate and the rate of return required for private investment prevent an equality between marginal social time preference and marginal social benefit. This article attempts to prove that these biases are exaggerated. The market cost of capital can be used to approach Pareto optimality in rationing capital between the public and private sector. The author shows that the social cost of capital must be higher than the government's borrowing rate since the government's borrowing rate arises from the government's legal superiority as a borrower against the private holders of all claims. This paper has implications for the extent of government investment in water resources and is relevant to water studies using social discount rates for investment decisions. (Murphy-Rutgers)
W70-10192

COMMENT ON VOTING AND SOCIAL CHOICE,
Indiana Univ., Bloomington.
Alfred Broaddus.
The American Economist, Vol 14, No 1, p 45-46, Spring 1970.

Descriptors: *Welfare preferences.
Identifiers: *Voting, *Social choice, *Social welfare function, Social ordering, Transitivity, Aggregate cycling phenomenon, Binary relation, Indifference, Voting class.

The author states that Campbell's paper is a closely reasoned attempt to extend and modify the results regarding social welfare functions achieved by Kenneth Arrow. Campbell found a family of social welfare functions, neither imposed or dictatorial, satisfying a set of conditions which includes a modified version of the original Arrow conditions. Campbell's social welfare function (R sub a) or rule for passing from individual to social orderings is such that social orderings established by it are transitive. This is accomplished at the prive of including a possible aggregate cycling phenomenon (C sub a) within the definition of the binary relation R sub a. The author feels that this inclusion weakens the intuitive appeal of Campbell's results. The author believes that Arrow's Condition 4 and 5 are simply Campbell's Conditions 7 and 6, respectively. In Section 3, Campbell demonstrates that any social welfare function satisfying his seven conditions must belong to the 'voting class'. Here the relevant question is whether or not all members of the 'voting class' satisfy Conditions 1-7. The theoretical use of a social welfare function or of social orderings is implied in the water area when deciding whether or not to invest in a particular public project. (Loeb-Rutgers)
W70-10195

PUBLIC BUDGETING AND FINANCE,
Georgia Univ., Athens.
Robert T. Golembiewski.
Itasca, Illinois, Peacock Publishers, 1968, 592p.

Descriptors: *Budgets, Planning, *Economic analysis, Forecasting, Management, Government, Decision-making, Financing, Management, Costs, Taxes, Subsidies, Optimization, Model studies, Control, Social aspects.
Identifiers: *Public budgeting, *Public finance, Budgetary procedure, Economic policy, Institutional aspects, Administrative problems, PPB.

A collection of readings is presented dealing with various aspects of public budgeting. It should be of interest to the water researcher since it provides the reader with an understanding of the numerous complexities and functions of budgeting in the public sector, where much of the water resource investment occurs. It first discusses the concept of what a budget is, how well it achieves its purpose and who should prepare it. The book then explains some of the aspects of the institutional contexts of public financing and budgeting followed by a group of articles relating some of the economic policy contexts. Some of the analytic models and actual patterns of decision-making are described, as well as the control function of budgeting. There are some articles on the behavioral and organizational contexts of public budgeting and finance with a final section on the budgetary process as a form of management. (See also W70-10197 thru W70-10200) (Murphy-Rutgers)
W70-10196

BUDGETS: DEFINITION AND SCOPE,
Texas Univ., Austin.
Andrew C. Stedry.
In: Public Budgeting and Finance, Itasca, Illinois, Peacock Publishers, 1968, p 6-14.

Descriptors: *Budgets, *Economic evaluation, *Planning, *Cost, *Economic efficiency, *Control, Industrial production, Forecasting, Management, Variance, Optimization.
Identifiers: *Standard costs, *Standards, Goals, Motivations, Budget control system.

The author defines what a budget actually is and states that its two major functions are to serve as a plan for future actions and as a means of control to encourage economic efficiency. These two functions are often interlaced to the point of indistinguishability but the author believes that the equality of figures used for the control and planning budgets is not necessarily correct. The author attempts to convey the applicability of the treatment of budgets to control systems, using standards and standard costs as elements of control, by discussing the similarity of the various elements. The concluding section evaluates the process by which the control given by the budget is exercised. As a means of increasing the effectiveness of the budgetary controls in the water resource area, this article deserves the interest of the water researcher. (See also W70-10196) (Murphy-Rutgers)
W70-10197

PERSPECTIVES ON POPULATION AND RESOURCES,
Resources for the Future, Inc., Washington, D.C.
Joseph L. Fisher.

In: Readings in Resource Management and Conservation, Chicago, University of Chicago Press, p 104-109, 1965.

Descriptors: *Natural resources, *Population, Conservation, Technology, Water resources, recreation, Forecasting, Economic justification, Research and development, Irrigation, Optimization, Capital, Investment, Water pollution, Water quality, Economic impact.
Identifiers: *Economic adaptations, Resource enterprises, Population growth, Leisure time, Capital formation.

The large problems are discussed which grow out of the resources- population relationship. He cites several studies which resulted in forecasts of United States population, demand for natural resources, and resource supply problems as far in the future as 2000. A pessimistic future was indicated unless: economic adaptations of techologic trends continue, resources can be obtained from foreign sources, or resource undertakings improve in farsightedness and consistency. Resource adequacy for the United States of a resource such as water was indicated as optimistic, although problems were likely to occur, such as having enough good quality fresh water in a particular place. The author suggests that cautious optimism is indicated due to recent advances, such as interest in stream pollution, improvement in water pollution abatement techniques, and inception of water quality control based on analysis of hydrologic, chemical and economic data. However careful control over the trends and forces influencing both population and resources is suggested, so that needed changes can be made. (See also W70-10196) (Murphy-Rutgers)
W70-10198

ECONOMICS AND THE APPLIED THEORY OF PUBLIC EXPENDITURES,
Minnesota Univ., Minneapolis.
Walter Heller.
In: Public Budgeting and Finance, Itasca, Illinois, Peacock Publishers, p 170-179, 1968.

Descriptors: *Budgeting, *Economic analysis, *Government, *Public benefits, Economic efficiency, Income, Cost minimization, Taxes, Benifits, Welfare economics, Prices, Industrial production, Subsidies, Profit.
Identifiers: Public goods, Stabilization, Want-satisfying, Voter preferences.

This paper is designed to show; where the economist can offer some useful counsel on the theory of government functions as they effect the budget, to indicate some lines along which promising work is being done, and to suggest certain limitations or constraints within which the economic criteria for dividing resources between public and private use must be applied. The author classifies and defines the basic economic objectives of government and studies the problems of determining the consumer's preferences for public goods and the maximum efficiency position between public and private economic control. The various methods of satisfying public wants are discussed from the point of view of minimizing costs. The paper concludes with a brief mention of some constraints on the application of specific economic criteria. The public good aspect of water resources should make this article of interest to the water researcher. (See also W70-10196) (Murphy-Rutgers)
W70-10199

CRITERIA OF EFFICIENCY IN GOVERNMENT EXPENDITURES,
Virginia Univ., Charlottesville.
Roland N. McKean.
In: Public Budgeting and Finance, Itasca Illinois, Peacock Publishers, p 516-521, 1968.

Descriptors: *Budgets, *Economic efficiency, *Economic evaluation, *Government, Systems analysis, Decision-making, Forestry, Management, Optimization, Maximization, Value, Prices.
Identifiers: *Personnel policy, *Economic criteria.

The author is concerned with the problems of choice and criterion difficulties in the attainment of efficiency. Particular emphasis is placed on the quantitative aspects of economic analysis. The process of maximizing economic efficiency usually requires a process of suboptimization which involves numerous complications in addition to inviting piecemeal analysis in decision-making. The proper criterion in economic evaluation is maximum output minus costs. As an example the author uses forest management to demonstrate the manner in which to choose among alternative sizes of the budget as well as among alternative personnel policies. The maximization of economic efficiency through the budget process is a problem continually faced by the water resources administrator. Accordingly, this article is relevant to the water resource planning process. (See also W70-10196) (Murphy-Rutgers)
W70-10200

INCOME REDISTRIBUTION AND SOCIAL CHOICE: A PRAGMATIC APPROACH,
Bowdoin Coll., Brunswick, Maine.
A. Myreck Freeman.
Public Choice, Vol VII, p 3-21, Fall 1969.

Descriptors: *Economic evaluation, *Income, Government, Optimization, Maximization, Taxes, Marginal analysis, Cost, Cost-benefit analysis, Decision-making, Federal government.
Identifiers: *Income distribution, *Social welfare function, *Paerto optimum, Utility possibility frontier, Government transfers, Social choice, Voting, Welfare maximization.

Modern formal welfare analysis points out the impossibility of ranking alternative positions on the utility possibility frontier due to the impossibility of making comparisons of individual utilities. However, many government programs, including many water resource development projects alter the distribution of income and thus this article is relevant to the water resource area. The author attempts to show that under plausible assumptions about behavior, individuals have incentives to develop institutions for making social choices about income distribution and that it is not unreasonable to assume that these choices reflect individual preferences. The article also attempts to provide a more pragmatic interpretation of the term social welfare function. The paper shows that if income distribution, chosen by individuals acting through some kind of political mechanism, can be assumed to be most preferred, this implies the existence of a social welfare function which has been maximized. If enough is known about the conditions under which this choice is made, the shape of this implied social welfare function can be determined. (Murphy-Rutgers)
W70-10201

DATA, RESEARCH, AND GOVERNMENT,
Yale Univ., New Haven, Conn.
Guy H. Orcutt.
American Economic Review, Vol LX, No 2, p 132-137, May 1970.

Descriptors: *Research and development, *Data collection, *Government, Population, Economic evaluation, Financing, Planning, Statistics, decision-making, Pollution, Computers.
Identifiers: *Economic research, *Social experimentation, *Institutional developments, Research institutes, Program evaluation.

How the federal government, foundations, and others can best aid the devleopment of more potent, social-problem and policy-orientated research is discussed. It should therefore be of value to those interested in increasing the quality and quantity of water resource economics research. The author favors real and relevant social experimentation and less of a dependence on government data collection for securing essential empirical evidence. Institutional developments are needed if essential collection of evidence i response to research requirements is to b achieved. The paper outlines these developmen and gives the sources from which the resources fo the proposed program would come. The paper co cludes with some general ideas on the financin evaluation and guidance of research program (Murphy-Rutgers)
W70-10202

P P B IN H E W: SOME MANAGEMENT IS SUES,
United States Conference of Mayors, Washingto D.C.
David R. Seidman.
Journal of the American Institute of Planners, V XXXVI, No 3, p 168-178, May 1970.

Descriptors: *Planning, *Budget, *Governmen *Economic evaluation, Management, Measur ment, Decision-making, Social aspects, Forecas ing, Systems analysis, Financing, Costs, Benefit Program, Risk.
Identifiers: *P P B, *Health Education and We fare, Agency conflict, Political difficulties progra structure.

Several issues are discussed on the operation of planning, programming and budgeting (P P B system. The author anticipates that the insights wi prove relevant to the operation of PPB in man agencies. Thus, those in the area of public wate resource investments should be aided in evaluatin their programs by a reading of this paper. Amon the issues covered are those of internal agency co flicts, measurement problems, and political di ficulties in introducing an innovative managemer technique into a very complex and often nonquan titative arganizational structure. The progra memoranda, program and financial plans, and spe cial analytic studies are discussed in the context H E W along with some of the problems involved i introducing PPB and developing it into an effectiv tool for decision-making. (Murphy-Rutgers)
W70-10204

THE CONCEPT OF CAUSALITY I ECONOMICS,
Illinois Univ., Urbana.
Julian L. Simon.
Kyklos, Vol XXIII, Fasc 2, p 226-254, 1970.

Descriptors: *Economics, *Correlation, Forecas ing, Interest rate, Income, Demand, Seasona Regression analysis, Time, Costs, Managemen Economic evaluation, Decision-making.
Identifiers: *Causality, *Logic, Spurious correl tion, Causal direction, Simultaneity, Advertising.

There has been no satisfactory definition of the us of the term causality in economics. No form definition of causality can be given that will enabl an economist to distinguish between those situ tions that are called 'causal' by most economist This paper attempts to supply an operation definition of causality that will aid the economist i distinguishing between those cases he wishes to ca causal and those he does not. Causal statements ar a sub-class of associations and gives an operation definition of causality that tests the followin characteristics of an association and its contex (A) predictability; (B) necessary side condition (C) spurious causality; (D) examination of how th case fits with economic theory. The potential cor fusion in many empirical water resource studie between correlation and causality should make th paper of interest to the water researcher. (Murphy Rutgers)
W70-10205

PROCEEDINGS AND ANALYSIS, WORKSHO ON THE PLANNING RESEARCH INTERFACE.
Maine Univ., Bangor. Water Resources Center.

Available from the NTIS as PB-194 565, $3.00 i paper copy, $0.65 in microfiche. University c Maine, 18-19 November 1969, p 88.

Descriptors: *Planning, *Interface, Research and development.
Identifiers: *Research, Water resources information, Workshops, Information exchange.

This workshop was designed to reveal the general nature of the interface dividing researches and planners. Ways were sought to manage, for increased public benefits; the reaction between researchers--as producers of water resources information, and planners--as consumers of that information. It was hypothesized that the information 'reaction' requires acceleration and should probably be reversible so that planners can stimulate the research process more directly. Two general lectures are included: 'A Case Study of the Minnesota Planning and Research Scene' and 'Planning and Problems of Interface'. Three discussion groups have been recorded. They included: 'Public Planning in Maine', 'Research--From Results to Relevance', and 'To What Extent are Research Inadequacies and Planning Failures Correlative.' Also included is a follow-up analysis of the workshops. (Davis-Chicago)
W70-10351

PLANNING AND PROBLEMS OF INTERFACE,
National Water Commission, Arlington, Va.
V. A. Koelzer.
In: Proceedings and Analysis, Workshop on the Planning/Research Interface, University of Maine, 18-19 November 1969, p 17-28. 1 fig.

Descriptors: *Planning, *Interface, Research and development, Institutions, Technology, Communication.
Identifiers: *Research, National water resources management.

Two topics are discussed. First, the tasks of the National Water Commission are outlined. A tentative program of 31 studies has been developed. These studies can be placed in four main categories: (1) studies to delineate future problems and needs; (2) studies to define the objectives of national water resources management, (3) studies to appraise existing institutional arrangements, (4) studies to provide a basis for recommending improvements in institutional arrangements. It is stressed that water resource planning should be recognized as a series of interim solutions rather than a final solution. Second, the problem of interfaces is discussed. Two types of planning interfaces are identified: the interface between research and planning and the interface between technical disciplines in planning. The major difficulty with the first interface is one of communication. Researchers frequently fail to present their knowledge in a form that is understandable to planners. Also there is a reluctance by planners to utilize new techniques that have not been operationalized due to lack of money and time. (See also W70-10351). (David-Chicago)
W70-10352

COMPREHENSIVE FLOOD PLAIN MANAGEMENT,
Office of the Chief of Engineers (Army), Washington, D.C.
George R. Phippen.
Water Resources Bulletin, Vol 6, No 4, p 640-647, July-August 1970. 3 fig, 3 ref.

Descriptors: *Water management (Applied), *Flood control, *Planning, *Flood plains, *Nonstructural alternatives, Flood damage, Cooperation, Open-space.
Identifiers: *Comprehensive flood plain management.

Comprehensive Flood Plain management is the special form of planning and action prompted by flood hazards. Much can be accomplished in the non-Federal sector, but there is also plenty of room for Federal-non-Federal cooperation. Appropriate use of the flood plain requires that hazards be resolved, and that this area function in concert with the larger community. Flood Plain Management objectives are stated in this context. The options for achieving these objectives range from high degrees of flood modification for intense development, as with flood control, to high degrees of susceptibility modification as achieved by public acquisition for open space. Although both forms of options merit consideration in all cases, flood modifying works are more likely to be indicated where a problem already exists, and susceptibility modifying options indicated where timely action can preclude inappropriate decisions. Portions of some flood plains are or will become intensively used or developed--in others, low intensity uses will be appropriate. In the usual case of a problem area the Corps will consider a mixture of current and future uses, and a combination of structural and nonstructural options will be embodied in the solution. (Mariott-Chicago)
W70-10355

THE MULTI-USER ZONE OF THE GULF OF MEXICO--ITS PROMISE AND PROBLEMS,
Texas A and M Univ., College Station.
Richard A. Geyer.
Water Resources Bulletin, Vol 6, No 4, p 580-587, July-August 1970. 5 fig, 2 tab.

Descriptors: *Coasts, *Management, *Gulf of Mexico, *Planning, Recreation demands, Environment, Industries, Jurisdiction, Coordination, Land use, Water utilization, Shore protection.
Identifiers: *Multi-user Zone.

There is an ever increasing intensification of the use of the coastal zone, including lake shores, as the expanding population of the United States moves into this area. Problems of conflicting use between industrial, commercial, recreational, and environmental interests are becoming more frequent. Coastal Zone Management must be concerned with provision of adequate recreational areas, industrial access and environmental preservation. To date effective coastal management has been thwarted by unclear jurisdictions and lack of coordination on the part of local, state and federal agencies. As the result of a two year study by the President's Commission on Marine Engineering and Resources, a number of specific recommendations are made for the Gulf of Mexico. Major recommendations include enactment of coastal management legislation, environmental conservation legislation, full utilization of land and water conservation funds, plans for better coordination between concerned agencies, support of feasibility and engineering studies relevant to the development of offshore industrial facilities, and review of enforcement procedures by federal agencies. Estimated costs of the various facets of the comprehensive plan for coastal management are summarized. (Mariott-Chicago)
W70-10356

AN ANALYSIS OF ALTERNATIVE METHODS OF FINANCING TYPES OF WATER RESOURCES FACILITIES IN MISSISSIPPI,
Mississippi State Univ., State College. Bureau of Business and Economic Research.
J. R. Pulley, and J. L. Roberts, Jr.
Water Resources Bulletin, Vol 6, No 4, p 522-527, July-August 1970.

Descriptors: *Financing, *Municipal water, *Water supply, Economic efficiency, Administration, Water rates.
Identifiers: Central Mississippi, Water Resources Facilities.

The purpose of the study was to investigate and anayze the alternative methods of financing types of water resources facilities used by selected communities in Central Mississippi, and to determine whether the method chosen was most feasible for the community. In the analysis an attempt was made to achieve four objectives: (1) determine the type of water facility needed in relation to use, (2) determine the underlying factors that cause this need, (3) determine the success of the financing method used, (4) determine and analyze any problem areas that arose as a result of the method of financing chosen. Only cities and communities in the process of expanding or constructing water facilities or which had done so during a five year period were studied. Two methods of financing water resource facilities; non-profit Water Associations serving villages and towns, and Municipal Water sources, are discussed in some detail, inciuding a discussion of the problems encountered with each. Principal problems associated with water system financing involve (1) size of municipality, and (2) overall direction of water system programs by competent and efficient administrators. Careful and proper planning is needed to alleviate problems and reach workable solutions. (Mariott-Chicago)
W70-10357

COMPREHENSIVE WATER PLAN, PHASE ONE.
Middlesex County Planning Board, New Brunswick, N.J.

Available from NTIS as PB-188 575, $3.00 in paper copy, $0.65 in microfiche. Comprehensive Master Plan, Part 8, October 1968. 50 p, 2 tab, 6 fig.

Descriptors: *Planning, *Water supply, *Water management (Applied), *Water distribution (Applied), Water sources, Water treatment, Water quality, Regulation, New Jersey, Water utilization.
Identifiers: *Middlesex County (New Jersey), Private on-lot systems, Public systems, Water resources usage.

This report inventories major private, municipal, and regional water supply systems serving Middlesex County Study Area. After a general discussion on nomenclature, private on-lot systems, public systems, and the usage and regulation of regional water resources, each water system is described in terms of its service area function, source of supply, and treatment, transmission and distribution facilities. (See also W70-10362) (Wexman-Chicago)
W70-10361

COMPREHENSIVE WATER PLAN, PHASE ONE: APPENDIX.
Middlesex County Planning Board, New Brunswick, N.J.

Available from NTIS as PB-188 576, $3.00 in paper copy, $0.65 in microfiche. Comprehensive Master Plan, Part TM 11, April 1968, p 45.

Descriptors: *Planning, *Water supply, *Water management (Applied), *Water distribution (Applied), Water quality, Water sources, Financing, Future planning (Projected).
Identifiers: *Middlesex County (New Jersey), Financing structure.

This appendix complements the Comprehensive Water Supply Plan, Phase One. It contains a physical description of all existing water supply facilities in Middlesex County and each of the 26 municipalities in the Study Areas. Service areas, source and capacities, water flow records, financing structure, problem areas and planned future projects are also briefly described. (See also W70-10361) (Wexman-Chicago)
W70-10362

PROCEDURES FOR EVALUATION OF WATER AND RELATED LAND RESOURCE PROJECTS, REPORT TO THE WATER RESOURCES COUNCIL BY THE SPECIAL TASK FORCE.
Water Resources Council, Washington, D.C.

Report, June 1969. 122 p, 1 tab.

Descriptors: *Evaluation, *Water resources, *Land resources, *Planning, Benefits, Costs, Water resources development, Analytic techniques, National income.

Identifiers: *Planning policies, *National objectives, Objectives, Regional development, Environmental enhancement.

This study is a review of present practices in the evaluation of benefits and costs in federal water resource projects together with several recommendations for revisions in current planning policies and practices. A statement of the national objectives for water resource development is presented; included are: national income, regional development, environmental enhancement, and well-being of people. This provides the framework in which the efforts of water and related land projects may be evaluated. For better communication and clearer presentation of information, these effects should be displayed in a system of accounts. Several critical issues that require special technical consideration are discussed. These include measurements of certain national or regional income changes arising from secondary effects, the treatments of costs and in some cases the definition of costs related to the national objective accounts, and formulation of plans in the context of several national objectives. (See also W70-10364 thru W70-10369) (Davis-Chicago)
W70-10363

SECTION I: INTRODUCTION.
Water Resources Council, Washington, D.C.

In: Procedures for Evaluation of Water and Related Land Resources Projects, Washington, D.C.: Water Resources Council, June 1969, p 6-15.

Descriptors: *Water resources, *Evaluation, Federal government, Water policy, Analytic techniques, Water resources development.
Identifiers: Federal policy, Policy.

A short history of the development of federal practices in the evaluation of water resource projects is undertaken. Emphasis is placed upon the development of present federal policy, stressing the increasing range of federal water resource development objectives and constraints placed upon evaluative techniques. Also discussed are some of the major contributions presented at a Water Resources Council hearing in conjunction with the preparation of the document. (See also W70-10363) (Davis-Chicago)
W70-10364

SECTION II: NATIONAL OBJECTIVES.
Water Resources Council, Washington, D.C.

In: Procedures for Evaluation of Water and Related Land Resources Projects, Washington, D.C.: Water Resource Council, June 1969, p 16-25.

Descriptors: *Water resources, *Evaluation, National income, Planning.
Identifiers: *National objectives, *Objectives, Regional development, Environmental enhancement, Well-being of people.

Four national objectives of water resource development are discussed; national income, regional development, environmental enhancement, and well being of people. National income measures the nation's output as the aggregate earnings of labor and property which arise from current and future production and the increase in national income attributable to a project is the measure of its contribution to this objective. Regional development objectives include: increased regional income, increased regional employment, improved regional economic base, improved income distribution, and improved quality of services. Environmental objectives include the conservation, preservation, creation, or restoration of natural, scenic, and cultural resources in order to enhance or maintain the quality of the environment. Well-being objectives consider the personal, group, and community effects of the project or program activity. These provide the framework in which the effects of water and related land projects may be evaluated. The details of these objectives are continually changing as national goals are defined and indeed new objectives might emerge. Comprehensive plans for water and related land resources use and development should be formulated in recognition of their contribution to all of these objectives. (See also W70-10363) (Davis-Chicago)
W70-10365

SECTION III: BENEFIT EVALUATION CONCEPTS.
Water Resources Councils, Washington, D.C.

In: Procedures for Evaluation of Water Related Land Resource Projects, Washington, D.C.: Water Resource Council, June 1969, p 26-53.

Descriptors: *Evaluation, *Benefits, *Costs, *Cost-benefit analysis, Water resources, Measurement, Associated costs, Induced costs, Tangible benefits, Intangible benefits.
Identifiers: Benefit evaluation concepts, Objectives, Primary benefits, Secondary benefits.

A number of basic evaluation concepts are discussed. Emphasis is placed on the evaluation principle that benefits and costs have meaning and can only be identified when directly related to objectives. Further, there is a need to clarify the definition of the specific type of benefits by function and their measurement standards in the context of all objectives and effects for resource development projects. The interpretation and modification of the general benefit definition is concerned with five areas requiring amplification: relation to objectives, identification of all beneficial contributions, measurement of benefit values, the 'with' and 'without' principle, and associated and induced costs. Also discussed were definitions of tangible and intangible benefits, and primary and secondary benefits. (See also W70-10363) (Davis-Chicago)
W70-10366

SECTION IV: NATIONAL OBJECTIVE ACCOUNTS.
Water Resources Council, Washington, D.C.

In: Procedures of Evaluation of Water and Related Land Resource Projects, Washington, D.C.: Water Resource Council, June 1969, p 54-65, 1 tab.

Descriptors: *Evaluation, *Analytic techniques, *Water resources, National income, Decision making.
Identifiers: *System of accounts, *National objective accounts, National objectives, Foregone opportunities.

A system of accounts is recommended that permits the display of the result of planning for any one national objective or any combination of national objectives. Under this system all national objectives are to be stated in quantitative terms to the extent possible, but not necessarily in national income terms. The formulation of comprehensive water resource programs involves two fundamental series of decisions: the choices among objectives and the choices of alternative means to achieve these objectives. The results of analyzing these potentials choices can be ultimately displayed in tables of national objective accounts. These tables include for each alternate plan, an accounting of the benefits and costs for that plan which are appropriate to each of the national objectives. Also included are the opportunities foregone by the adoption of a particular plan compared with each of the other plans. (See also W70-10363) (Davis-Chicago)
W70-10367

SECTION V: PLAN FORMULATION.
Water Resources Council, Washington, D.C.

In: Procedures for Evaluation of Water and Related Land Resource Projects, Washington, D.C.: Water Resource Council, June 1969, p 66-73.

Descriptors: *Evaluation, *Planning, *Wate resources, Formulation, Benefits, Optimization Methodology, Analytic techniques.
Identifiers: *Plan formulation, Objectives, Syste of accounts.

A number of considerations regarding plan formu lation are outlined. First, project plans may be for mulated to achieve any specified objectives withi the concept of the four major categories of objec tives. The evaluation of benefits over time is as sociated with projections of the needs for good and services. Water resource planning should al ways involve adequate representation from th area under study. Optimizing principles used i plan formulation for the national income objectiv do not serve as well in the plan formulation of th other objectives. Consideration must be given t complementary and supplementary projects an programs which may be involved. A more involve process is encountered with plan formulation wit multiple objectives. If a system of accounts is util ized to clearly show the effects and relationship of project to objectives, the method of optimizing on objective within constraints imposed by other ob jectives is an acceptable approach to multiple ob jective formulation. A more complex and difficul method would be to optimize multiple objective although this approach requires further research (See also W70-10363) (Davis-Chicago)
W70-10368

SECTION VI: EVALUATION PRACTICES AN MEASUREMENT TECHNIQUES.
Water Resources Council, Washington, D.C.

In: Procedures of Evaluation of Water and Relate Land Resource Projects, Washington, D.C.: Wate Resource Council, June 1969, p 74-119.

Descriptors: *Evaluation, *Measurement *Analytic techniques, Costs, Benefits, Alternativ costs, National income, Water supply, Irrigation Water quality, Flood control, Drainage, Recrea tion.
Identifiers: *Objectives, Land stabilization, Fis and Wild life, Use externalities, Resource immo bilities, Regional development, Environmenta enhancement, Well-being of people.

Evaluation practices and measurement technique are discussed for each of the objectives. The use o alternative costs as a measure of benefits is also ex amined. Within the national income objective number of primary benefits are analyzed: wate supply, irrigation, water quality control, navigation electric power, flood control and prevention, lan stabilization, drainage, recreation, and fish an wild life. Secondary national income benefits ar discussed stressing conditions for identification use externalities and resource immobilities requirements; and general measuremen techniques. The other objectives, regional develop ment objectives, environmental objectives, an well-being objectives are also discussed. (See als W70-10363) (Davis-Chicago)
W70-10369

ESTUARINE CLEAN WATER COST-BENEFI STUDIES,
International Water Pollution Research Con ference (5th).
For primary bibliographic entry see Field 05G.
W70-10373

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE TRUE RATE OF RETURN AND TH REINVESTMENT RATE,
Columbia Univ., New York.
Michael Adler.
The Engineering Economist Vol 15, No 3, p 185 187, Spring 1970.

Descriptors: *Economic evaluation, *Investment, Capital, *Costs, Profit, Economic life, Optimization, Decision-making, Income, Management, Uncertainty.
Identifiers: *Internal rate of return, *Net present value, *Reinvestment rate, Sinking fund, Depreciation, Profit rate.

It is important, in water resources investments, that there be an accurate assessment of the costs and benefits of alternative projects. It has long been known that the reinvestment rate assumption can cause differences in the ordering of projects ranked by net present value as opposed to internal rate of return calculations. A proposal is examined for reconciling the two methods and shows that the size of the chosen reinvestment rate is relatively unimportant. A common reinvestment rate can be assumed for all projects which can then be ranked according to their true rates of profit. Relatively large errors in the assumed reinvestment rate will be of little concern. (Murphy-Rutgers)
W70-10186

NOTE ON THE CHOICE OF INTEREST RATES IN COST-BENEFIT ANALYSIS,
London School of Economics and Political Science (England).
J. A. Walters.
Economica Vol XXXVII, No 145, p 78-80, February 1970.

Descriptors: *Discount rate, *Rate of interest, Economic evaluation, *Cost-benefit analysis, Decision-making, Planning, Optimization, Income, Maximization, Prices, Cost, Government.
Identifiers: *Long-term rate, *Short-term rate, Programming, *Rate of return, Securities.

Cost-benefit analysis is widely used to evaluate investments in the water resources field. This article deals with the necessary problem of choosing a discount rate when using this method of analysis. There is no accepted opinion on the appropriate interest rate to be used; some analysts prefer the long term rate, others the short rate. The author shows that there is a straight forward theoretical programming solution to the problem. It involves the comparison of the rate return on the investment with an investment in government securities. (Murphy-Rutgers)
W70-10193

AN AGGREGATE HOMOTHETIC PRODUCTION FUNCTION,
Maryland Univ., College Park.
Raul A. Meyer.
The Southern Economic Journal, Vol XXXVI, No 3, p 229-238, January 1970.

Descriptors: *Returns to scale, *Economic efficiency, Costs, Mathematical study, Prices, Total costs, Average cost, Statistics, Regression analysis, Capital, Labor, Correlation, Wages, Income, Economic evaluation.
Identifiers: *Homothetic production function, Elasticity of substitution, *Cost minimization, Homogeneity, Isoquants.

A homothetic production function is compared with the Cobb-Douglas (C-D) and constant elasticity of substitution (C E S) type of production functions. It is usually assumed, in water utility studies, that constant returns to scale exist and the C-D and C E S production functions are the type most often estimated. This author calls into question the assumptions implied in several production functions concerning returns to scale and the elasticity of substitution. He demonstrates that the assumptions of a homothetic production function are less restrictive than those of the C-D and C E S functions since the latter are a special case of a homothetic function. The author concludes that since the extra cost of estimating a general homothetic function is often quite small, the data rather than a priori assumptions should be allowed to determine the value of important parameters. Thus, this production function may be used to more accurately describe the production relations in the water resources area. (Murphy-Rutgers)
W70-10203

MUNICIPAL UTILITY BOND FINANCING,
Felicity A. Bray.
Journal of the American Water Works Association, Vol 62, No 8, p 468-472, August 1970.

Descriptors: *Financing, *Economics, Planning, Water resources development, Public utilities, Investment, Costs.
Identifiers: *Bond issue, *Revenue bonds, General obligation bonds, Prospectus.

Revenue producing utilities which are municipally owned and run usually depend on interest bearing bonds for the funding of capital improvements. The financial arrangements must correspond to the type of utility and its expected life. Various financial arrangements are discussed. The role of the engineering consultant in estimating the cost and feasibility of capital improvements is discussed. Factors affecting interest rates of bonds are presented. The function of the financial consultant in minimizing interest rates and in the preparation of the bond issue is explained. The provisions and covenants of revenue bonds which make them attractive and safe for the investor are discussed. Pitfalls of revenue bond financing are mentioned, and the importance of good financial counsel in avoiding them is stated. The bond prospectus is a very important document in a sound financing program. The requirements of a good prospectus are enumerated. The effectiveness of the prospectus and a credit rating service in increasing the number of potential investors is demonstrated. (Hewett-Rutgers)
W70-10347

SOME ECONOMIC ASPECTS OF WATER REUSE IN CZECHOSLOVAKIA,
International Water Pollution Research Conference (5th).
For primary bibliographic entry see Field 05D.
W70-10372

6D. Water Demand

LINEAR PROGRAMMING MODELS FOR ESTIMATING THE AGRICULTURAL DEMAND FUNCTION FOR IMPORTED WATER IN THE PECOS RIVER BASIN,
New Mexico Univ., Albuquerque.
Micha Gisser.
Water Resources Research, Vol 6, No 4, p 1025-1032, August 1970. 8 p, 1 fig, 4 tab, 13 ref.

Descriptors: *Water demand, *Inter-basin transfers, Texas, *Mathematical models, *Linear programming, Irrigation water, Water costs, Economics, Sprinkler irrigation, Demand, Parametric hydrology, Water supply, New Mexico.
Identifiers: Agricultural water demand, Pecos River Basin.

Parametric linear programing methods were used to estimate the agricultural demand function for imported water in the Pecos basin. A parametric linear programming model suitable for the Pecos basin was developed. Agricultural activities in which land is irrigated either by local or imported water and by either ditch or sprinkler irrigation were developed and adjusted for forecasted 1980 prices. These agricultural activities were used by the parametric linear programing mode, and various agricultural demand functions were obtained for the Pecos basin. These functions show the expected quantitites of imported irrigation water that would be demanded at different prices and under a variety of constraints. (Knapp-USGS)
W70-10055

A HYDROLOGIC BUDGET FOR A SOUTHERN ALBERTA IRRIGATION DISTRICT,
Department of Agriculture, Lethbridge (Alberta). Research Station; and Alberta Univ., Edmonton. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
W70-10298

WATER RESOURCES PROBLEMS: PRESENT AND FUTURE REQUIREMENTS FOR LIFE,
H. C. Pereira.
In: Use and Conservation of the Biosphere, p 71-85, Unesco, Paris, 1969.

Descriptors: *Hydrologic cycle, *Planning, *Water quality, *Watersheds (Basins), Nuclear energy, Nuclear powerplants, Irrigation effects, Arid lands, Semiarid climates, Tropical regions, Saline water systems, Saline water-freshwater interfaces, Runoff, Precipitation (Atmoshperic), Erosion, Vegetation effects, Groundwater, Surface waters, Rivers, Dams, Evaporation, Water storage.
Identifiers: *World water problems, *Water quantity.

The hydrologic cycle is described as a closed, balanced system characterized by circulating water whose major source and sink are the oceans. The primary equations describing the hydrologic cycle cannot be altered, but equilibria can and are, primarily by man's intervention. Disturbances at any level create perturbations at many other levels, and water projects must therefore be carefully and rationally planned. Man must plan not only in terms of quantity but also the quality of water related to specific needs, and this must be augmented by data collection, technical training and land-use planning concomitant with the hydrologic possibilities of a given area. Problems of vegetation manipulation, surface storage development, groundwater storage and maintenance and improvement of quality are described for a variety of climates and specific areas. Recent alleviating technological innovations are also considered in detail. The special problems of high-rainfall and arid areas are extensively described and it is felt that man's environmental misuse may be measured by soil erosion in arid areas and by water pollution in wet climates. Major conclusions are: (1) River basins, and sometimes groundwater basins are the fundamental units of water resources development; (2) River basin studies should recruit a variety of disciplines--not merely engineers. (Casey-Arizona)
W70-10312

6E. Water Law and Institutions

FUGETT V STATE (CONSTITUTIONALITY OF COMMERCIAL FISHING REGULATION).

188 SW2d 641-643 (Ark 1945).

Descriptors: *Arkansas, *Commercial fishing, *Regulation, *Legislation, Fish conservation, Fish, Fishing, Sport fishing, State governments, Governments, Wildlife, Judicial decisions, Legal aspects, Adjudication procedure, Natural resources, Conservation.
Identifiers: *Constitutionality.

Appellant commercial fisherman was convicted of violating a state law which required commercial fisherman to throw back undersized fish but contained no such restrictions on other fishermen. Appellant contended that the law unconstitutionally discriminated against him since other fishermen could take small fish for their own consumption while he could not because of his occupation. Affirming the conviction, the court held that, since fish and other game are the property of the state, they are subject to state regulation. The wisdom and manner of such regulation is for the legislature, not the courts. If the legislature decides a particular conservation measure is necessary to protect the state's resources, the court will not strike down that measure unless it clearly contravenes the constitution. (Liptak-Florida)
W70-10072

JOHNSON V SOWELL (DAMAGE MEASURE WHERE SAND AND GRAVEL BASIN OVERFLOWS ONTO ADJOINING FARMLAND).

15 So 2d 688-689 (Miss 1944).

Descriptors: *Mississippi, *Overflow, *Damages, *Submergence, Flooding, Farms, Farm ponds, Pastures, Compensation, Judicial decisions, Legal aspects, Sands, Gravels, Leases, Weeds, Mosquitoes, Value, Impoundments, Excavation, Impounded waters.

Defendants, holders of a sand and gravel lease on lands adjacent to plaintiff's farm, impounded waters on the leased land for use in the sand and gravel process. This basin overflowed, submerging an acre and a half of plaintiff's pasture land. In plaintiff's suit for damages, she sought compensation for: (1) the destruction of a small pond on her land; (2) sand and gravel wrongfully taken from her land by defendants; (3) the full value of the submerged land; and (4) mosquito infestation caused by the weeds fringing defendant's intruding impoundment. The lower court awarded plaintiff the total sum of $800, and the Supreme Court of Mississippi affirmed on condition of remittitur. The court noted that full-value recovery could not be had for the submerged land since the land would regain its original value when the gravel operation ultimately ceased. Also, there could be no recovery for mosquito damage since defendants could reasonably impound waters on their premises even though the mosquito population would thereby be increased. The mere fact that the impoundment extended onto plaintiff's land did not make plaintiff more susceptible to mosquito damage than she would have been had the impoundment remained on defendant's land. (Marsee-Florida)
W70-10115

THE LONG COUNT ON DEMPSEY: NO FINAL DECISION IN WATER RIGHT ADJUDICATION,
Montana State Univ., Bozeman. Water Resources Research Center.
Albert W. Stone.
Montana Law Review, Volume 31, No. 1, Fall 1969. 27 p. OWRR Project A-031-MONT (1).

Descriptors: *Water law, *Water rights, Legislation, Montana.
Identifiers: Adjudication, Water code.

This review brings up to date the chronicle of litigation on Dempsey Creek, a small stream of less than twenty miles in length: fourteen lawsuits with eight decisions by the Montana Supreme Court. In nearly every one of these lawsuits, all or substantially all of the people in the community of Dempsey Creek were litigants. There seems little risk in predicting that the past is but a prelude to continuing and endless litigation in the future. This history of unending litigation among neighbors on a small watershed speaks for itself on the futility of Montana's present system of stream adjudication. A complete overhaul of the law was introduced in the last legislative session as part of House Bill No. 337, but failed passage. Such legislation would be a great boon to Montana and to all persons who deserve a secure and definite priority without endless lawsuits.
W70-10124

IN RE GILLESPIE (CITY'S ACQUISITION OF WATER RIGHTS BY CONDEMNATION).

272 NY 18, 3 NE2d 618-620 (1936).

Descriptors: *New York, *Water supply, *Eminent domain, *Riparian rights, Streamflow, Water rights, Public rights, Riparian land, Railroads, Streams, Natural flow doctrine, Flooding, Water injury, Condemnation, Alteration of flow, Legal aspects, Judicial decisions, Water law, Municipal water, Water sources, Cities, Local governments, Tunnels, Legislation.

Plaintiff New York City Board of Water Supply petitioned for condemnation of water rights in a stream appurtenant to defendant railroad's property. Plaintiff sought the right to increase or decrease the normal flow of the stream as necessary for the city's water supply. Defendant contended that the petition was improper since plaintiff failed to comply with state law providing for negotiations with railroads prior to condemnation proceedings. Moreover, any increase in the stream's flow during high water would cause flooding and damage to defendant's land. Reversing a judgment for defendant, the Court of Appeals of New York held that the negotiation statute permitted, but did not compel, plaintiff to negotiate before bringing a condemnation petition. The court further noted that the acquisition of the right to increase or decrease the normal flow of the stream did not contemplate abnormal or flood conditions, and plaintiff could acquire no such right to cause damage to defendant's land. (Liptak-Florida)
W70-10136

STEINLE V CITY OF CINCINNATI (CITY'S LIABILITY FOR SUBSIDENCE DAMAGE CAUSED BY LEAKING SEWERS).
142 Ohio St 550, 53 NE2d 800-803 (1944).

Descriptors: *Ohio, *Subsidence, *Settlement (Structural), *Sewers, Drainage water, Judicial decisions, Adjudication procedure, Legal aspects, Condemnation, Eminent domain, Compensation, Land tenure, Real property, Cities, Municipal water, Local governments, Waste water disposal, Damages, Leakage.

Plaintiff property owner sought damage for a taking of her property resulting from defendant city's negligent maintenance of its sewer system. The alleged negligence had allowed sewage water to escape onto plaintiff's land causing subsidence of plaintiff's house. Plaintiff contended that the intrusion of the water was a temporary appropriation of her property for public use. Defendant argued that plaintiff had purchased the property after the damage had occurred and therefore was not the proper party to bring the action. Affirming a judgment for defendant, the court noted that although plaintiff attempted to introduce an assignment of the claim from the former owner, the evidence did not appear until after plaintiff began her action. Therefore, at the time of the institution of the action, she was not the real party in interest. (Liptak-Florida)
W70-10138

PEOPLE V STATE TAX COMM'N (FRANCHISE ASSESSMENT OF RAILROAD CROSSINGS OVER NAVIGABLE STREAMS).
29 NE2d 932-933 (NY 1940).

Descriptors: *New York, *Railroads, *Bridges, *Assessments, Transportation, Streams, Navigable waters, Ownership of beds, Judicial decisions, Adjudication procedure, Legal aspects, Taxes, Evaluation, State governments, Administrative decisions, Administrative agencies.

Plaintiff railroad sought to review defendant tax commission's franchise assessment of three bridges or trestles which crossed certain creeks. Plaintiff contended that the assessments were illegal because: it owned the submerged bottom under the crossings, the crossings were not over navigable water, and the crossings were less than 250 feet in length. The Court of Appeals of New York affirmed per curiam the lower appellate court's decision in favor of defendant. The lower court had affirmed the assessments on the ground that the creeks were public navigable waters and the crossings were all over 250 feet in length. (Liptak-Florida)
W70-10140

STATE V CITY OF CLEARWATER (MUNICIPAL OPERATION OF YACHT BASIN).
184 So 790-797 (Fla 1938).

Descriptors: *Florida, *Cities, *Docks, *Engineering structures, Piers, Judicial decisions, Legal aspects, Coastal structures, Marinas, Construction, Maintenance, Channels, Breakwaters, City planning, Water resources development, Operation and maintenance.
Identifiers: *Yacht basins.

Petitioner municipality, in an attempt to construct, operate and maintain a yacht basin, passed an ordinance authorizing such activity and then petitioned the court for validation and confirmation of the issue of yacht basin revenue certificates. The state's attorney challenged the authority of petitioner to construct, operate and maintain a yacht basin. The Supreme Court of Florida affirmed a circuit court decision validating the issue of the revenue certificates. The court concluded that the Florida statute authorizing petitioner to construct, maintain and operate wharves, ship channels breakwaters and other facilities authorized such city to construct, operate and maintain a yacht basin. (Powell-Florida)
W70-10162

SKRMETTA V ALABAMA OYSTER COMM (REGULATION OF OYSTER TAKING TO CONSERVE STATE PROPERTY).

168 So 167-170 (Ala 1936).

Descriptors: *Alabama, *Conservation, *Regulation, *Public benefits, Navigation, Ownership of beds, Legislation, Judicial decisions, Legal aspects, Public rights, Relative rights, State governments, State jurisdiction, Watercourses (Legal), Fish conservation, Wildlife conservation, Adoption of practices, Economics, Preservation, River regulation, Fish management, Inspection, Administrative agencies, Supervisory control (Power).

Defendant oyster commission passed a regulation forbidding the taking of oysters by dredging on all public reefs and state-owned bottoms in Alabama waters. Plaintiff contended the establishment of the commission was an unconstitutional delegation of legislative authority and sought to enjoin the application of the regulation. The court stated that the state owns the absolute property in the oyster bed and oysters in her navigable waters, holding it in trust and for the use of her people, subject only to the paramount right of navigation. The power and duty of the state to protect such interests of the public by regulation is not subject to reasonable debate. The regulation challenged was valid as its purpose was to conserve state property, and the powers and purposes of the oyster commission were sufficiently specific. The judgment denying plaintiff an injunction was affirmed. (Price-Florida)
W70-10164

GREAT LAKES PORTS FACE FORMIDABLE CHALLENGES,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
Harry C. Brockel.
Seaway Review, Vol 1, No 1, p 5-8, 26, Spring 1970. 1 fig.

Descriptors: *Navigation, Ships, Harbors, Canals, Locks, *St. Lawrence Seaway, Great Lakes.
Identifiers: Welland Canal, Lash Ships.

The role of the St. Lawrence Seaway has already begun to change. The new ship building and port technologies, as well as changing economic conditions, have affected the commerce potentialities of the Seaway Corporation. Although both the Canadian and U.S. governments have insisted that the operational costs of the seaway be met by tolls, the U.S. government has not used many of its indirect powers to encourage seaway use. For instance, the Defense Department has avoided the use of lake ports and U.S. rail rate structures discriminate against fresh water gateways. The author concludes that unless lake ports are modernized they will become primarily ports for gathering ship

which will meet transoceanic container liners at Montreal to transport commerce back and forth to the lake ports. (Holmes-Rutgers)
W70-10176

STATE GAME AND FISH COMMISSION V LOUIS FRITZ CO (REMOVAL OF ROUGH FISH).

193 So 9-18 (Miss 1940).

Descriptors: *Mississippi, *Fish, *Fish management, *Fish conservation, Judicial decisions, Legal aspects, Water conservation, Lakes, Carp, Riparian rights, Water policy, Turtles, Nets, Administrative agencies, Supervisory control (Power), Regulation, Rough fish.
Identifiers: *Non-game fish.

Plaintiff was the owner of more than nine-tenths of the shoreline of an inland, freshwater, non-tidal natural lake. Defendant Game and Fish Commission executed a contract to remove non-game gross fish from said lake. Plaintiff obtained a temporary injunction enjoining defendants from seining the lake and removing such fish. The Supreme Court of Mississippi held that plaintiff was not entitled to recover from defendant or its members the value of the fish taken from the lake. The injunction was allowed to stand since the members of the court were equally divided on that question. Separate opinions of the justices were presented. (Powell-Florida)
W70-10178

WOODBURY V MUNICIPAL COUNCIL OF GLOUCESTER (ARBITRARY REVOCATION OF FISH-TRAP PERMIT).

61 NE2d 647-650 (Mass 1945).

Descriptors: *Massachusetts, *Fishing gear, *Permits, *Regulation, Judicial decisions, Legal aspects, Cities, Local governments, Commercial fishing, Fishing, Nets, Trapping, Governments, Bays, Oceans, Tidal waters, Navigable waters, Federal government.

Plaintiff fisherman sought review of defendant town's revocation of plaintiff's license to maintain a fish trap. Plaintiff contended that the revocation was arbitrary in that defendant's intent was to grant a license to someone else to maintain a trap at the same location. Defendant argued that plaintiff's license was improperly granted since plaintiff's predecessor's license was still outstanding when plaintiff acquired his license. Quashing the town council's revocation order, the court held that even though the right to maintain a structure in navigable waters is merely a revocable privilege, the revocation cannot be based on arbitrary or capricious grounds. Further, the court noted that plaintiff's predecessor had the right to surrender his license before it expired, which he did, making the grant of plaintiff's license perfectly valid. (Liptak-Florida)
W70-10180

DEL BALSO HOLDING CORP V MCKENZIE (RENT AS PREREQUISITE TO EXERCISE OF RIPARIAN RIGHT TO ACCESS BY PIER).
271 NY 313, 3 NE2d 438 (1936).

Descriptors: *New York, *Riparian rights, *Piers, *Permits, Riparian waters, Navigable waters, Banks, Riparian land, Landfills, Public rights, Legal aspects, Ownership of beds, Usufructuary right, Water law, Judicial decisions, Adjudication procedure, Access routes, Right-of-way, Administrative agencies, Regulation, Local governments, Cities, Land tenure, Real property, Rent.

Plaintiff riparian owner applied for a writ of mandamus to compel defendant Commissioner of Docks of New York City to issue a permit for the construction of a pier on a creek. Plaintiff contended that, as a riparian owner, he had a right of access by means of a pier to navigable water fronting his upland. However, defendant sought to collect rent for the erection and maintenance of the pier. Defendant contended that plaintiff was not a riparian owner but that he had illegally filled the land in question, which actually belonged to the city. Consequently, defendant contended that it could charge plaintiff rent to enter the land and build a pier. On plaintiff's appeal, the court noted that each party was correct as to the law pertaining to his own version of the facts. The case was remanded for a determination of the facts. (Liptak-Florida)
W70-10182

IN RE PUBLIC BEACH, BOROUGH OF QUEENS, CITY OF NEW YORK (CONDEMNATION VALUE OF WATERFRONT PROPERTY BURDENED WITH EASEMENT).
269 NY 64, 199 NE 5-10 (1935).

Descriptors: *New York, *Condemnation, *Easements, *Condemnation value, Eminent domain, Beaches, Judicial decisions, Legal aspects, Right-of-way, Cities, Public benefits, Value, Evaluation, Land use, Compensation, Local governments, Governments, Recreation, Swimming, Recreation facilities, Damages.
Identifiers: Servitudes.

Appellee city brought condemnation proceedings to acquire land for the purpose of establishing a public beach or park. The parcel of land involved was a strip of waterfront property owned by the appellant property association. The association owned the waterfront property subject to an easement in favor of all owners of all lots on a designated map to use and enjoy the beach for bathing and other recreation and sport. For the purpose of maintaining the association's property as a private beach, appellant association received membership fees from the property owners. The association appealed a judgment awarding nominal damages in the condemnation proceeding. The Court of Appeals held that the association was entitled to more than nominal damages since ownership and right of beneficial enjoyment were vested in the appellants. The court stated that the ultimate question in condemnation proceedings is not whether land taken is burdened by servitude, but rather the value of land for any use consistent with the burden on it. (Powell-Florida)
W70-10183

NATIONAL CELLULOSE CORP V STATE (STATE'S LIABILITY FOR APPOPRIATION OF PAPER COMPANY'S WATER RIGHTS).

292 NY 438, 55 NE2d 492-496 (1944).

Descriptors: *Damages, *New York, *Appropriation, *Pulp and paper industry, Canals, Dams, Riparian rights, Riparian waters, Riparian land, Natural flow doctrine, Streamflow, Judicial decisions, Legal aspects, Compensation, State governments, Natural streams, Competing uses, Navigable waters, Preferences (Water rights), Hydraulic machinery, Reservoirs, Channel improvement, Locks, Powerplants.

Plaintiff paper products company brought an action against defendant State of New York to recover loss of profits and the cost of converting from water power to electric power. The loss allegedly resulted from defendant's improvement of a dam for use in connection with a barge canal. Plantiff contended that, after the improvements, defendant used more water than it was entitled to, with the result that at various times there was insufficient water flow to operate plaintiff's plant. This caused plaintiff to lose business and to convert its plant to electric power. Defendant argued that the damages should be limited to the value of the water of which plaintiff was deprived. Affirming a judgment for plaintiff, the Court of Appeals of New York held that plaintiff was entitled to recover all elements of damage that necessarily resulted from defendant's interference with plaintiff's riparian rights. (Liptak-Florida)
W70-10211

RYDER V TOWN OF LEXINGTON (CITY'S LIABILITY FOR WATER DAMAGE CAUSED BY DRAINAGE WATER OVERLOAD OF STREAM).
21 NE2d 382-390 (Mass 1939).

Descriptors: *Massachusetts, *Water injury, *Surface drainage, *Drains, Drainage systems, Drainage water, Surface waters, Surface runoff, Streams, Tile drains, Natural flow doctrine, Flood damage, Prescriptive rights, Judicial decisions, Legal aspects, Water law, Riparian land, Culverts, Cities, Local governments, Adjudication procedure, Drainage effects, Riddance (Legal aspects), Excess water (Soils), Outlet works.

Plaintiff landowners brought an action against defendant town to recover for damage to their land. The damage was allegedly caused by defendant's construction of drains which discharged more surface water into a stream than the stream could handle, thereby flooding plaintiff's land and interfering with the natural drainage of the land. Plaintiffs contended that the discharge of water into the creek without any improvement in the creek's capacity, or in the size of the culvert downstream from plaintiff's property, constituted a trespass on their land. Defendant argued that the drains were installed by public officers for whose acts the town could not be liable and that the town had acquired a prescriptive right to flood the property since the flooding had continued for five years. Affirming a judgment for plaintiff, the court held that the officers who supervised the drain construction were acting as the town's agents, for whose actions the defendant could be liable. The court held further that no prescriptive right to inflict damage on another's land arises from the improper maintenance of a drainage system. (Liptak-Florida)
W70-10214

HAMRICK V CITY OF ALBERTVILLE (CITY'S LIABILITY FOR FLOODING CAUSED BY ROAD IMPROVEMENT).
189 So 545 (Ala 1939).

Descriptors: *Alabama, *Cities, *Road construction, *Flooding, Adjudication procedure, Judicial decisions, Roads, Maintenance, Legal aspects.

Complainant sought to enjoin the taking of his land or, in the alternative, to recover damages for trespass to--and flooding of--the land. The flooding was alleged to have resulted from respondent city's straightening of a road. The Supreme Court of Alabama held that the complainant had not met the burden of proof of establishing the acts alleged. Moreover, the weight of the evidence showed that complainant had for a long time acquiesced in the road work, and complainant's land was in reality enhanced in value by the improvements. (Marsee-Florida)
W70-10217

CITY OF SHREVEPORT V CASE (ULTRA VIRES REGULATION OF MOTOR CRAFT ON LAKE)
198 La 702, 4 So 2d 801-804 (1941).

Descriptors: *Louisiana, *Lakes, *Public benefits, *Boating regulations, Cities, Navigable waters, Ownership of beds, Legislation, Local governments, Water demand, Water supply, Water conservation, River regulation, Pollution, Public health, Pollution abatement, Legal aspects, Judicial decisions, Public rights, Relative rights, Water policy, Supervisory control (Power).

Plaintiff city unsuccessfully attempted to prosecute defendant for operating a motor boat on Cross Lake without a muffler in violation of a city ordinance. Defendant contended the city had been granted authority to pass ordinances affecting the lake only for the purpose of protecting the water supply from pollution and contamination. The city

contended that its power over the lake was plenary. The court ruled that the power granted was clearly meant to be limited to protecting the lake from pollution, and not to be construed as a more general police power. Regulations pertaining to the operation of motor boats without mufflers have no relation to the prevention of pollution and contamination. The ordinance in question was therefore void since it was passed without proper authority. The judgment for defendant was affirmed. (Price-Florida)
W70-10285

EX PARTE GUTHRIE (CITY'S CHARTER POWER TO REGULATE FISHING).
2 So 2d 121 (Fla 1941).

Descriptors: *Florida, *Cities, *Supervisory control (Power), *Fishing, Fish conservation, Judicial decisions, Legal aspects, Regulation, Legislation.

The city charter of Sarasota, Florida granted the city--for municipal purposes only--powers over and title to tidewater and other lands, river and bay bottoms, waters, waterways and water bottoms. Under the charter the city sought to regulate fishing within its boundaries. The Supreme Court of Florida hald that the case of Nash v Vaughn, 133 Fla. 499, 182 So 827, was controlling on the question of the city's authority to so regulate. A legislative grant of the power to regulate fishing did not clearly appear from the language of the charter and could not therefore be recognized. The grant of the land and waters in the charter was limited for municipal purposes and no other. (Marsee-Florida)
W70-10287

SKIRIOTES V STATE (CONSTITUTIONALITY OF FLORIDA'S MARINE BOUNDARY).
197 So 736-739 (Fla 1940).

Descriptors: *Florida, *State jurisdiction, *International waters, *Commercial fishing, Legal aspects, Judicial decisions, Political aspects, International law, Treaties, Legislation, Marine animals, Fishing gear.
Identifiers: *Sponge industry, *Marine boundary, Constitutionality.

Subsequent to his criminal prosecution for the illegal taking of sponges in the Gulf of Mexico, petitioner sought certiorari on appeal. Petitioner admitted taking the sponges with illegal diving apparatus in the location described, but asserted that the marine boundary of Florida was fixed by international law at one marine league (three nautical miles) from the shore, and since the offense was committed beyond this limit, Florida was without jurisdiction. The Florida 1885 constitution fixed the marine boundary at three marine leagues (nine nautical miles). Petitioner contended this provision violates the United States Constitution, federal treaties and executive orders. Moreover, petitioner contended that the act of Congress in readmitting Florida to the Union had not constituted an approval of Florida's marine boundary. The Supreme Court of Florida noted that the marine boundaries of other states extended as much as nine leagues from the shore and that these boundaries were approved by Congress in the same manner as Florida's. In denying the writ of certiorari, the court noted that any state has the right to reasonably fix its marine boundary with the approval of Congress and concluded that the long acquiesence by Congress in the boundary fixed by Florida conclusively indicated such congressional approval. (Hart-Florida)
W70-10295

BENSON V CITY OF ANDALUSIA (CONSTITUTIONALITY OF ORDINANCE FOR OPERATION OF CITY SEWAGE SYSTEM).

195 So 443-446 (Ala 1940).

Descriptors: *Alabama, *Sewers, *Legislation, *Cities, Municipal wastes, Public health, Urbanization, Sewage disposal, Judicial decisions, Legal aspects, Taxes, Operating costs, Payment, Regulation, Relative rights.
Identifiers: *Constitutionality.

Defendant city owned a sewer system. Pursuant to its operation, an ordinance was enacted providing for a sewer service charge commensurate with the number of connections served, a fine for failure to pay the charge, and disconnection from the system after 30 days delinquency. Plaintiff sought to have the ordinance declared invalid, contending that it was: (1) arbitrary, unreasonable, and discriminatory; (2) a taking of property without due process; (3) a tax; and (4) a denial of equal protection of the law. Affirming the lower court's decree for defendant, the court found that: (1) the complaint failed to allege facts showing that the ordinance was unreasonable and arbitrary; (2) the sewer system was municipal property and, since plaintiff had no interest therein, disconnection was not a taking without due process; (3) the charges were for special benefits for certain persons so they could not be construed a general tax; and (4) the ordinance was within the police power. (Hart-Florida)
W70-10299

CHAMBERLAIN V BOARD OF COMM'RS (CONSTITUTIONALITY OF PROPOSED BOND ISSUE).

11 So 2d 724-732 (Ala 1943).

Descriptors: *Alabama, *Income, *Debt, *Tunneling, Urbanization, Interest, Tunnel construction, Cities, Underground structures, Loans, Cost repayment, Judicial decisions, Legal aspects, Legislation, Rivers, Navigable rivers, River beds, Ownership of beds, Reservation doctrine, State governments.
Identifiers: *Constitutionality.

Plaintiff Board of Commissioners brought a petition in equity against defendant taxpayers and citizens of Mobile to determine the authority of the city to issue revenue bonds. Plaintiff had constructed a tunnel under the Mobile River by pledging toll revenue to secure a bond issue. The use of the toll revenue was restricted to paying interest and bond capital and tunnel maintenance. Plaintiff proposed to issue more bonds, with the proceeds to be used to redeem the prior bonds and to extend and enlarge the tunnel project. Plaintiff contended that since the new bonds would pledge revenue from the then municipally-owned tunnel, a constitutionally prohibited city debt would be established. However, the court found that since the Mobile River was navigable, the river bed and therefore the tunnel was state property which was controlled by the legislature. Since the city did not own the tunnel, and the legislature had authorized the toll use for only a specific purpose, the court held that the city was only a quasi-trustee for the toll revenue and therefore the bond issue would not create a city debt. The decision of the lower court for defendant was affirmed. (Hart-Florida)
W70-10302

TOWN OF FRISCO CITY V GREEN (CITY'S BURDEN OF PLEADING COMPARATIVE INJURY DOCTRINE WHERE CITY'S SEWER POLLUTES BRANCH FLOWING THROUGH DAIRY).

12 So 2d 409-410 (Ala 1943).

Descriptors: *Alabama, *Adjudication procedure, *Pollution abatement, *Dairy industry, Damages, Sewers, Sewage, Sewage disposal, Sewage effluents, Streams, Pastures, Livestock, Milk, Odor, Wet seasons, Overlfow, Judicial decisions, Legal aspects, Municipal wastes, Relative rights.
Identifiers: *Injunctions, Contamination.

Plaintiff dairyman sued defendant city seeking t abate a nuisance. Defendant's sewer discharge into a wet weather branch flowing across plaintiff dairy pasture, and in times of wet weather, th branch overflowed, spilling the polluted water over plaintiff's pasture. Plaintiff alleged that thi overflow resulted in: (1) foul odors in and aroun his nearby dwelling, (2) making the waters of th branch unfit for his herd's consumption, and (3 contaminating the pasture grasses and milk fror his cows. Defendant relied on the 'comparative ir jury doctrine', contending that plaintiff had not a alleged facts from which the court coul reasonably determine whether the granting of th injunction sought would result in a greater incor venience or hardship to the city than the plaintif would suffer by its denial. The lower court ove ruled defendant's demurrer and the Supreme Cou of Alabama affirmed, holding that 'comparative ir jury' was a defense and placed the burden of proc on the defendant. Plaintiff had no burden in hi pleadings of raising or anticipating such defens (Marsee-Florida)
W70-10303

CITY OF CLANTON V JOHNSON (ABATABL NUISANCE AS CONSTITUTED B NEGLIGENT MAINTENANCE OF SEWERAG SYSTEM).

17 So 2d 669-673 (Ala 1944).

Descriptors: *Alabama, *water pollution contro *Waste disposal, *Sewage disposal, Judicial dec sions, Legal aspects, Riparian rights, Water poll tion sources, Public health, Drainage, Drainag systems, Drainage water, Drainage practice Ditches, Drains, Rain water, Compensatio Damages, Sewers, Sewage, Sewage treatmen Public benefits, Cities, Disposal, Creeks, Wat pollution effects.

Untreated sewage from defendant city's sewerag system poured into a creek which traversed plai tiff's property and caused certain injury theret Plaintiff filed a bill in equity against defendant t recover damages and to abate the negligent mai tenance of such sewerage system, such mai tenance allegedly constituting a private nuisanc Defendant demurred, contending the action w barred by the statute of limitations since actio arising out of tort were to be initiated within s months of the accrual of the cause of action. Th court found that the negligent maintenance of th sewerage system constituted an abatable nuisanc A cause of action did not arise until the harmf consequences occurred, and each occurrence recurrence of such damages constituted a separa cause of action. The assessments in this complai were therefore sufficient to make the bill good against a general demurrer. The judgment f plaintiff was affirmed. (Price-Florida)
W70-10330

CITY OF CORAL GABLES V CRANDON (CO STITUTIONALITY OF STATUTE ESTABLIS ING WATER CONSERVATION DISTRICTS).
25 So 2d 1-3 (Fla 1946).

Descriptors: *Florida, *Water conservatio *Legislation, *Public benefits, Conservatio Drains, Runoff, Ditches, Water table, Wat supply, Water districts, Water demand, Water co sumption (Excludes consumptive use), Wat resources, Water levels, Public health, Publ benefits, Public rights, Economics, Populatio Census, Saline water intrusion, Taxes, Financing.

Plaintiff sought to enjoin the enforcement of statute relating to the creation of water conserv tion districts in counties having a population more than 260,000 according to the last feder census. Plaintiff contended the statute was enacte as a general law when it was in fact a local law, th proper notice had not been given and that t statute imposed a tax without the authority of la The court pointed out that due to excessive runof

drainage of fresh water, increased population, lowering of fresh water levels, and the invasion of salt water into areas previously occupied by fresh water, a serious problem had developed concerning a source of fresh water supply. The challenged statute was enacted to reduce the seriousness of the problem. The court said that notice of its passage was not required and that the classification on the basis of population had a proper basis in the subject regulated. The court also rejected plaintiffs' contention of unlawful taxation by citing previous cases. (Price-Florida)
W70-10348

DOUCET V TEXAS CO (RELATIVE RIGHTS OF MINERAL LESSEES AND OYSTER LESSEES).
205 La 312, 17 So 2d 340-349 (1944).

Descriptors: *Louisiana, *Leases, *Oysters, *Oil wastes, Pollution, Effluents, Sponges, Clams, Hydrogen sulfide, Chemical wastes, Gases, Fuels, Diseases, State governments, Legislation, Relative rights, Judicial decisions, Legal aspects, Oil water, Pollutants.

Plaintiff sued defendant corporation in damages for the value of oysters allegedly killed in beds leased by plaintiff from the state as a result of defendants' pollution of the waters over said beds by its oil operations. Defendant denied liability and contended it was operating under a lease from the state and that its operations were conducted under the best conditions and in accord with approved methods. Defendant also contended plaintiff had failed to prove the proximate cause of the death of the oysters. The court said it was never the intention of the legislature to give to mineral lessees the right to operate in such a manner as to pollute the waters in utter disregard for the rights of oyster lessees. Based on expert testimony relating to extensive experimentation as to the cause of death of the oysters, the court concluded the pollution of the waters with oil and other effluents discharged therein by defendant company was the proximate cause of the death of plaintiff's oysters. The judgment in favor of defendant was reversed. (Price-Florida)
W70-10353

ENFORCEMENT LIMITATIONS IN WATER QUALITY CONTROL,
Federal Water Quality Administration, Washington, D.C.
For primary bibliographic entry see Field 05G.
W70-10354

THE MULTI-USER ZONE OF THE GULF OF MEXICO--ITS PROMISE AND PROBLEMS,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 06B.
W70-10356

ALEXANDER V CITY OF SHREVEPORT (EROSION OF PROPERTY BY WATER FLOWING FROM CITY CULVERT).

205 La 480, 17 So 2d 716-719 (1944).

Descriptors: *Louisiana, *Ditches, *Accelerated erosion, *Diversion, Superimposed drainage, Drainage effects, Drainage practices, Drainage water, Soil conservation, Storm drains, Cities, Urbanization, Culverts, Erosion, Soil erosion, Damages, Judicial decisions, Legal aspects, Adjudication procedure, Cities, Water injury, Drainage programs, Watersheds (Basins), Small watersheds, Natural flow doctrine.

Plaintiff landowner sought injunction to prohibit defendant city from permitting surface water to flow over his land and also sought damages for injury therefrom. Plaintiff owned several lots upon which a small ditch was dug. Water from a municipal culvert draining a 40 acre watershed flowed through this ditch onto plaintiff's land, causing severe erosion. Plaintiff contended that defendant dug the ditch, and that defendant had diverted water over his property. The Supreme Court affirmed the trial court's judgment for defendant, holding that plaintiff had failed to prove either of these contentions. The court also rejected plaintiff's assertion of res ipsa loquitur since defendant did not have exclusive control of plaintiff's property. (Hart-Florida)
W70-10358

EMERY V ORLEANS LEVEE BD (DEDICATION OF STATE PROPERTY VIA ACT AUTHORIZING PROJECT CONSTRUCTION).
207 La 386, 21 So 2d 418-424 (1945).

Descriptors: *Louisiana, *Levees, *Spillways, *Condemnation, Floods, Flood control, Flooding, Floodproofing, Flood protection, Floodwater, Floodways, Legislation, Mississippi River, Condemnation value, Compensation, State governments, Eminent domain, Public benefits.

The state legislature authorized the construction of a spillway for flood protection purposes in 1924 and authorized the taking of certain lands for that purpose. In 1938, after the completion of the spillway, plaintiffs obtained a certificate of redemption from the state which they claimed title to part of the land under the spillway. Defendant levee board contended that since at the time of the act authorizing the building of the project, the land was then owned by the state, it was dedicated thereby for public use. The court held for defendant stating that at the time of the authorization of the spillway construction, the land in dispute was effectively taken out of commerce and thereafter remained in the ownership of the state. (Price-Florida)
W70-10359

EVANS V DUGAN (PRIVATE USE OF STATE-OWNED SHORE).
205 La 398, 17 So2d 562-566 (1944).

Descriptors: *Louisiana, *Relative rights, *Lake shores, *Public benefits, Riparian rights, Riparian waters, Riparian land, Navigable waters, Shores, Lakes, High water mark, Public rights, Spillways, Dams, Impounded waters, State governments, Impoundments, Recreation, Legal aspects, Judicial decisions, Legislation.

Plaintiff owned property fronting on the shore of a lake. The shore was state property and under the control of a state agency. Defendant owned and operated a fishing camp on said shore. Plaintiff sought to have defendant's residence and camp removed as a nuisance, and contended defendant had appropriated state property for his private use. Defendant contended he was granted permission by the state agency in charge to build and operate such camp as it was deemed to be in the best interest of the general public. Based on the evidence in the record, the court found that defendant was not a trespasser and that the camp operated by him in no way constituted a nuisance but rather was a public convenience. Operation of the camp by defendant did not deprive plaintiff of the free use of the lake shore, and he was not hampered in any way in his rights of fishing, boating, landing or traveling on or along the lake shore. Plaintiff had no right to demand the ejectment of defendant from said shore. The judgment for defendant was affirmed. (Price-Florida)
W70-10413

FILTROL CORP V HUGHES (REASONABLE USE OF LAND AFFECTING SURFACE RUNOFF).
23 So 2d 891-892 (Miss 1945).

Descriptors: *Mississippi, *Surface runoff, *Rainwater, *Reasonable use, Judicial decisions, Legal aspects, Water rights, Overland flow, Surface drainage, Surface waters, Topsoil, Mining, Excavation, Earthworks, Excess water (Soils), Gravitational water, Relative rights, Discharge (Water), Damages.

Plaintiff and defendants were adjoining landowners. Surface water naturally flowed from defendants' land onto plaintiff's land. Defendants were engaged in the removal of clay containing bentonite, and rain water collected in the resulting excavation. Defendants discharged such collected surface water in a body which resulted in damage to plaintiff's land. The Supreme Court of Mississippi affirmed the trial court's judgment of damages for plaintiff and determined that although defendants had the right to make reasonable use of their land without liability to the plaintiff for any unavoidable injury caused him as a result of an incident thereto, defendants did not have the right to cause surface water to be collected and discharged in a body onto plaintiff's land so as to abnormally affect such land. (Powell-Florida)
W70-10420

UNITED STATES V MEYER (DISCRETION IN EXERCISE OF EMINENT DOMAIN AND DAMAGE ARISING THEREFROM).
113 F2d 387-398 (7th Cir 1940).

Descriptors: *United States, *Condemnation, *Eminent domain, *Damages, Condemnation value, Easements, Legal aspects, Compensation, Dams, Dam construction, Damsites, Mississippi River, Illinois, Rivers and Harbors Act, Legislation, Subsurface drainage, High water mark, Riparian rights, Relative rights, Governments, Navigation, Boundaries (Property), Judicial decisions, Administration decisions.

In a condemnation action brought by the United States, defendants' land was taken in fee pursuant to a plan to construct a dam on the Mississippi River. Defendants had cross-claimed to prohibit the taking and also to recover for alleged damage to the subsurface drainage of lands not taken. The taking in fee was challenged as unnecessary and as an abuse of discretion by the Secretary of War. The Seventh Circuit Court of Appeals ruled that the Secretary was authorized by Congress to decide the extent of the exercise of eminent domain practices, and unless an abuse of discretion could be proved, the decision was not reviewable. The court further ruled that the alleged damage to the subsurface drainage was not a taking within the meaning of the fifth amendment but was caused by raising the water level to the ordinary high water mark, which was authorized by the power of the government over navigable waters. The taking in fee and the award of the district court were affirmed. (Barker-Florida)
W70-10423

WASHINGTON WATER POWER CO V UNITED STATES (EVALUATION OF RIPARIAN LAND IN CONDEMNATION SUIT BY UNITED STATES).
135 F2d 541-543 (9th Cir 1943).

Descriptors: *Washington, *Compensation, *Condemnation value, *Condemnation, Eminent domain, Federal government, Judicial decisions, Legal aspects, Land tenure, Local governments, Ownership of beds, Preferences (Water rights), Public benefits, Relative rights, Riparian land, Water rights, Watercourses (Legal), Value, Market value, Property values, Appraisals, Assessments, Evaluation, Land appraisals.

Plaintiff United States had condemned certain riparian land belonging to defendant power company, and compensation therefor was established. Defendant contended a greater compensation should be paid as the property was adaptable for power-site purposes. Plaintiff contended that while such a use was possible under some circumstances, it could not here be exercised. The court, in holding for plaintiff, stated that a riparian owner has no property right in the bed of a stream or to the use of

the water or the power inherent therein as against the United States, and therefore such riparian owner may not recover for the potential power-site value of the riparian lands. (Price-Florida)
W70-10424

IN RE EAST RIVER DRIVE (NO TITLE PASSES TO UNDERWATER LANDS RESERVED FOR PUBLIC STREETS).
159 Misc 741, 289 NYS 433-458 (Sup Ct 1936).

Descriptors: *New York, *Grants, *Ownership of beds, *Road construction, Underwater, Cities, Land, Land use, Management, Land development, Roads, Public lands, Construction, Easements, Judicial decisions, Legal aspects, Condemnation, Access routes, Local governments.
Identifiers: *Underwater lands, *Adverse possession (Legal aspects).

Defendant city gave a series of grants of underwater lands to plaintiffs' predecessors in interest. However, defendant reserved the right to use all or part of these underwater lands for public streets. Up to the time of the condemnation proceeding brought by defendant, no streets had been constructed under the terms of the grants. Plaintiffs claimed title to these underwater lands on the ground that the reservation as stipulated in the original grants was never effectuated and was, therefore, meaningless. Plaintiffs also contended that they held title by adverse possession by virtue of an easement of access and egress over such reserved lands. The court denied plaintiffs' claim of title by adverse possession, as plaintiffs' easement could not ripen into fee title by adverse possession. The court found title to be in defendant, and stated that even though streets were never constructed on the underwater lands, according to defendant's right under the terms of the grants, this did not alter the terms of the grants nor nullify the reservation imposed by such grants. (Finman-Florida)
W70-10425

MILLER V UNITED STATES (EVALUATION OF LAND CONDEMNED BY UNITED STATES).
For primary bibliographic entry see Field 04A.
W70-10428

RUSSELL AND CO V PUERTO RICO (IMPAIRMENT OF CONTRACT FOR WATER RIGHTS).

118 F2d 225-231 (1st Cir 1941).

Descriptors: *Puerto Rico, *Contracts, *Taxes, *Irrigation districts, Administrative decisions, Appropriation, Community development, Condemnation, Eminent domain, Judicial decisions, Legal aspects, Legislation, Preferences (Water rights), Public benefits, Relative rights, Riparian land, Riparian rights, Riparian waters, Water transfer, Irrigation, Water rights, Usufructuary right.

Plaintiff Puerto Rico had been authorized by act of the Puerto Rican legislature to construct and maintain an irrigation district using the water of the Jacaguas River. Plaintiff had also been given the authority to condemn the water rights of all users not located within the district. This arrangement was unacceptable to the users, however, because they needed the water to grow their crops. In lieu of purchasing their water rights, plaintiff entered into a contract with defendants in which plaintiff promised to deliver to each of them an amount of water equivalent to their water right in consideration for which defendants would relinquish said water rights. Later the legislature passed a bill taxing all users of irrigation water on a per acre basis, defendants included. When defendants refused to pay, plaintiff brought this action to collect such taxes. The court held that such a tax on defendants constituted an impairment of the obligation of contract by the government. But for the contract, defendants had a right to use the waters of the river for free. They relinquished that right in consideration for the delivery of an equivalent amount of water. The governmental imposition of a tax constituted an additional condition not bargained for. (Clarke-Florida)
W70-10429

UNITED STATES V CHICAGO BURLINGTON AND QUINCY RR (RECOVERY OF DAMAGES PROXIMATELY CAUSED BY DAM CONSTRUCTION).
90 F2d 161-173 (7th Cir 1937).

Descriptors: *United States, *Mississippi River, *Condemnation value, *Dam construction, Dams, Dam design, Damsites, Sediment control, Eminent domain, Right-of-way, Damages, Railroads, Condemnation, Compensation, High water mark, Banks, Rivers, Lakes, Tributaries, Drainage patterns (Geologic), Judicial decisions, Legal aspects.

Plaintiff United States brought action to condemn a tract of land for the construction of a dam on the Mississippi River. Defendant railroad was awarded damages for the loss of its claim of ownership in the tract and was further given an award for damage which would be done to its rights-of-way, road beds, bridges, and embankments which were located above the dam site beyond the boundaries of the condemned tract. The United States appealed claiming that such damage was remote, consequential and speculative, and thus no award could be given. The Seventh Circuit Court of Appeals, affirming the district court's judgment for defendant, ruled that such damage was proximately caused by the construction of the dam. By filing the condemnation action, the United States impliedly promised to pay for the proximate damage to defendant's remaining property beyond the location of the dam. (Barker-Florida)
W70-10430

UNITED STATES V ALASKA'S PACKING CO (PROSECUTION FOR OIL POLLUTION).
84 F2d 444-446 (9th Cir 1936).

Descriptors: *Washington, *Legislation, *Oil, *Water pollution, Water pollution sources, Pollutants, Oil wastes, Oily water, Ships, Navigable waters, Lakes, Admiralty, United States, Federal government, Judicial decisions, Legal aspects, Regulation, Adjudication procedure.
Identifiers: *Oil pollution.

Plaintiff United States brought libel against defendant vessel for discharge of oil into navigable waters. Defendant contended that the wording of the statute on which the libel was based, ' (i)t shall not be lawful. . .to discharge. . .refuse matter of any kind or description whatever. . .into navigable water,' did not prohibit oil pollution. This contention was supported by the legislative history of a different act, the Oil Pollution Act. Rejecting the proposition that the legislative history of a different act than the statute in question might reveal congressional intent, the court held that the prohibition included the discharge of oil, and reversed the judgment of the lower court for defendant. (Hart-Florida)
W70-10438

REAMS V CITY OF LONDON (SUIT FOR DAMAGES TO PROPERTY CAUSED BY POLLUTION OF A STREAM).

293 Ky 473, 168 SW2d 994-996 (1943).

Descriptors: *Kentucky, *Water pollution, *Sewage effluents, *Treatment facilities, Structures, Cities, Water pollution sources, Water pollution effects, Land use, Damages, Legal aspects, Sewage disposal, Land tenure, Adjuciation procedure, Remedies, Judicial decisions.

Plaintiff sought damages for the pollution of a stream flowing through his property. The damage was allegedly caused by a malfunction of the defendant city's sewage treatment plant. Plaintiff alleged that the damage was caused by the construction of a permanent structure, and that he should be able to collect past and future damages in one action. The city denied these allegations, and further claimed that the pollution existed when the plaintiff purchased the property in question. At trail, the jury had rendered a verdict for the defendant. The court held that the verdict had been based either on the proposition that the city had not caused the pollution, or that the condition existed when plaintiff bought the land. As there was evidence presented which could sustain either finding, the trial court's verdict was sustained. (Caldwell-Florida)
W70-10439

STONE V CITY OF ASHLAND (CITY'S LIABILITY FOR WATER POLLUTION FROM MUNICIPAL SEWERS).
32 NE2d 560-561 (Ohio Ct App 1939).

Descriptors: *Ohio, *Water pollution, *Cities, *Sewers, Municipal wastes, Natural streams, Streams, Pollutants, Effluents, Oilywater, Sewage, Sewage effluents, Local governments, Judicial decisions, Legal aspects, Water law, Drainage water, Runoff, Drains, Sewage disposal, Adjudication procedure, Remedies, Compensation, Damages.

Plaintiff landowner brought an action against defendant city for damages caused by defendant's maintenance of its drainage and sewer system. Defendant's system had polluted the stream running through the city and onto plaintiff's property. Plaintiff contended that such maintenance of the sewers, and the city's permitting others to add to the pollution of the stream, was a nuisance, for which defendant was liable. Defendant argued that the evidence did not establish that the city had polluted the stream and, that in any event, maintenance of the sewers was a governmental function for which there could be no liability. Affirming a judgment for plaintiff, the court held that, although the decision to construct a sewer system is a governmental function, the actual maintenance and operation of the sewers is a ministerial function for which a city can be liable. The evidence clearly supported the jury's verdict. (Liptak-Florida)
W70-10440

LIVEZEY V TOWN OF BEL AIR (DUTY OF MUNICIPALITY TO OPERATE ITS SEWAGE DISPOSAL PLANT IN SUCH A WAY AS NOT TO CREATE A NUISANCE).
199 A 838-843 (Md 1938).

Descriptors: *Maryland, *Pollution abatement, *Sewage disposal, *Municipal wastes, Cities, Sewers, Condemnation, Effluents, Fishkill, Organic wastes, Waste disposal, Drainage systems, Drainage programs, Pollution abatement, Pollution identification, Pollutants, Natural flow doctrine, Sanitary engineering, Judicial decisions, Legal aspects.

Plaintiff sought to enjoin defendant city from operating its sewage disposal plant. Defendant had allegedly polluted a stream which ran through plaintiff's land. Two issues were present: did defendant pollute the stream, and was plaintiff entitled to injunctive relief. The court stated that it is the right of every riparian owner to enjoy in its natural state, in flow, quantity and quality, a natural stream running through his property. A municipality, in making its drains and sewers, is not immune from liability of it so constructs or maintains them so as to amount to a nuisance. The court ruled that the evidence was sufficient to sustain a finding that the pollution and resulting damage was caused by defendant's operation of the sewage plant, and that plaintiff was entitled to relief. Where the nuisance operates to destroy health, or impair the enjoyment of property, and no adequate remedy at law exists, injunctive relief must be granted. However, the court applied the doctrine ofalancing of equities due to the grave hardship and opportunity for disease the immediate shutdown of the disposal plant

would create, and defendant was given a reasonable time to rectify the situation. Such correction not appearing, plaintiff could reinstitute his bill. The trial court's decree for defendant was reversed. (Price-Florida)
W70-10441

THE PANAM (LIBEL FOR THE DISCHARGE OF OIL INTO COASTAL NAVIGABLE WATERS).
54 F Supp 461-462 (D NJ 1944).

Descriptors: *New Jersey, *United States, *Water pollution sources, *Oil, Water pollution, Coasts, Ships, Storms, Navigable waters, Judicial decisions, Legal aspects, Admiralty, Water pollution control, Oil wastes, Oily water, Federal jurisdiction.
Identifiers: *Oil Pollution Act.

A libel action was brought against the oil tanker Panam for the discharge of oil into the coastal navigable waters of the United States. The Panam left Curacao bound for New York carrying a cargo of oil. Before departure the ship had been thoroughly inspected and had received two certificates of seaworthiness. Due to the continuous pounding of the seas as a result of a storm encountered en route, the rivets below the water line were sprung and began to leak oil into the water. The court held that libellant was not entitled to recover in this action because the discharge of oil upon the coastal, navigable waters was involuntary and accidental, and was caused by the abnormal or unusual pressure or strain upon the vessel as a result of the encountered storm. The discharge of oil was deemed an unavoidable accident, and was therefore not a violation of the Oil Pollution Act. (Barnett-Florida)
W70-10442

TRUSTEES OF INTERNAL IMPROVEMENT FUND V STARK (ACTION OF EJECTMENT TO RECOVER ARTIFICIALLY MADE STRIP OF COASTAL LANDS).

25 F Supp 730-732 (SD Fla 1938).

Descriptors: *Florida, *United States, *Riparian rights, *Spoil banks, Rivers, Navigable waters, Dredging, Channels, Channeling, Bays, Administration, Administrative agencies, Legal aspects, Judicial decisions, Boundary disputes, Shore protection, Coasts, Excavation, Civil engineering, Tidal waters, Islands, Riparian land, River beds, River training.

Plaintiffs, Trustees of the Internal Improvement Fund, sought to recover a small strip of land running parallel to the shoreline of the upland which was owned by defendants. This land was connected to the mainland at one end by a narrow neck and otherwise was separated from the mainland by navigable waters, thus creating a peninsula. There was no physical connection between defendant's mainland property and the peninsula. The land in question was created by the United States' dredging a channel and depositing the spoil in the shallow portion of the river. Defendants moved onto the parcel but had no record title to the peninsula. They claimed the land as against plaintiffs solely as owners with riparian rights of the neighboring upland. Plaintiff acquired the land pursuant to statutory provisions in a manner found by the court to be fully in compliance therewith. Upon the strength of this title, the court held that plaintiffs were entitled to have defendants ousted from the land. (Barnett-Florida)
W70-10443

SHUSTER V CITY OF CHISHOLM (LIABILITY FOR POLLUTION OF STREAM).
282 NW 135-136 (Minn 1938).

Descriptors: *Water pollution, *Minnesota, *Municipal wastes, *Sewage effluents, Water pollution sources, Sewage, Riparian land, Riparian rights, Riparian waters, Cities, Local governments, Sewage disposal, Waste water (Pollution), Judicial decisions, Legal aspects, Streams.

Plaintiff brought action against defendant city for damages which resulted from defendant's pollution by the discharge of sewage into a river which flowed by their farm. The court concluded that even though evidence showed another town also contributed sewage to the river, defendant and the other town were independent, not joint, tortfeasors. Evidence showed that defendant's sewage substantially contributed to the nuisance and was a proximate and contributing cause of plaintiff's damage. The lower court's judgment for plaintiff was affirmed. (Morris-Florida)
W70-10444

NELSON V TOWN OF NORTHUMBERLAND (TOWN'S RESPONSIBILITY TO MAINTAIN SEWERS PROPERLY).
5 A2d 39-40 (NH 1939).

Descriptors: *New Hampshire, *Sewage disposal, *Sewers, *Damages, Sewage, Sewage effluents, Cities, Legal aspects, Judicial decisions, Surface drainage, Surface runoff, Surface waters, Conduits, Construction costs, Drainage systems.

Plaintiff landowner brought action against defendant town for the alleged improper construction and maintenance of defendant's sewer. Plaintiff sought damages for injury to her property caused by the overflow of said sewer. Defendant contended that plaintiff had failed to establish the requisite causal connection between the alleged deficiencies in defendant's sewer and the damage suffered by plaintiff. From a judgment for plaintiff, defendant appealed. Defendant's appeal was based on its exception to the charge of the trial court to the jury that plaintiff was entitled to recover if the sewer was not sufficient to take care of the sewerage and surface water. The Supreme Court of New Hampshire held that the charge was erroneous and constituted reversible error. The court also ruled that the proper measure of damages would be either the cost that plaintiff originally incurred when connecting with defendant's sewer or the cost of constructing her private sewerage disposal plant. A new trial was ordered. (Price-Florida)
W70-10445

CAMDEN SEWER CO V MAYOR AND COUNCIL (USE OF SEWERS IN SURFACE WATER DRAINAGE).
185 A 126-129 (Md 1936).

Descriptors: *Maryland, *Local governments, *Sewers, *Surface drainage, Excess water (Soils), Community development, Contracts, Drainage, Judicial decisions, Legal aspects, Legislation, Natural flow doctrine, Overlying proprietor, Relative rights, Public rights, Water transfer, Drainage systems, Storm drains, Sewage disposal, Surface runoff.

Defendants mayor and city council granted plaintiff sewer company the franchise to lay sewer mains along an avenue and certain lateral streets. The city retained the right to drain surface water into the main sewer as long as it did not interfere with the primary purpose of the sewer. Instead, the city constructed catch basins which drained water into the lateral sewers, and eventually such sewers became choked with debris carried by the surface waters. Plaintiff sued for reimbursement of the expense of removing the obstruction, but received a verdict at trial of only $100. Plaintiff appealed on the grounds that the trial judge had refused to instruct the jury that under the franchise ordinance, defendant had no right to drain surface water into the lateral sewers. The appellate court held that this was a proper and necessary instruction and that plaintiff was injured by the trial judge's refusal to give it. A new trial was granted. (Clarke-Florida)
W70-10446

MIAMI BEACH JOCKEY CLUB V DERN (REVOCATION OF FILL PERMIT IN BISCAYNE BAY).
83 F2d 715-720 (DC Cir 1936).

Descriptors: *Florida, *Navigable waters, *Permits, *Land forming, Land development navigation, Inland waterways, Harbors, Non-navigable waters, Channels, Bays, Inlets (Waterways), Administrative agencies, Administrative decisions, Decision making, Judicial decisions, Legal aspects, Landfills, Regulation, Supervisory control (Power).

Plaintiff jockey club sought an injunction to prevent defendant Secretary of War from interfering with a bulkhead and fill project in Biscayne Bay. Plaintiff obtained a fill permit from defendant which was later revoked after protests by local landowners. Plaintiff contended that: (1) since Biscayne Bay was nonnavigable, defendant had no authority over the project; (2) defendant had no power to revoke the permit once granted; and (3) the revocation was arbitrary. The court stated that the bay was navigable in law if navigable in fact, adding that waters susceptible to use as a highway are navigable in fact. Because of its use in international shipping and its navigational channels authorized by Congress, the court held that the bay was navigable. Finding that defendant was authorized to revoke the permit, which was a mere license, and that the revocation was not arbitrary, the court denied the injunction sought by plaintiff. (Hart-Florida)
W70-10447

DE ROCHE V OSBORNE (POLLUTED WATER EVEN WITHOUT CONTAMINATED CLAMS JUSTIFIES CLOSING CLAM BEDS TO COMMERCIAL DIGGING).
37 NYS2d 348-351 (Sup Ct 1942).

Descriptors: *New York, *Clams, *Public health, *Commercial fishing, Conservation, Administrative agencies, Judicial decisions, Legal aspects, Regulation, Public benefits, State governments, Local governments, Cities, Water pollution, Social aspects, Commercial shellfish, Administrative decisions, Remedies.

Petitioner clam digger instituted a proceeding against New York defendants, Conservation Commission and Board of Health, to rescind defendants' order and resolution prohibiting the digging of hard clams in certain New York bays. Petitioner contended the order was unreasonable because New Jersey had not closed clam beds in portions of the same bays under its jurisdiction, and the clams dug therefrom were being sold in New York markets. Petitioner also argued that the report on the public health aspects of clamming in the bays failed to show a single contaminated clam. The Supreme Court of Richmond County, New York denied petitioners' application upon a showing that before the hearing New Jersey had taken the same action as defendants. The court affirmed the defendants' authority to certify those lands from which shellfish may be taken for use as food and to gulate all health matters. The court stated that where it was found that waters in which clam beds were located were polluted, defendants were justified in closing clam beds to commercial digging without waiting until clams themselves had become contaminated. (Powell-Florida)
W70-10448

BOARD OF SUP'RS V FRISBEE (CONDEMNATION VALUE OF PUBLIC EASEMENTS).
18 NYS2d 668-670 (Sup Ct 1940).

Descriptors: *New York, *Condemnation value, *Easements, *Local governments, Condemnation, Compensation, Access routes, Shores, Shore protection, Lakes shores, Lake Ontario, Coastal structures, Project purposes, Docks, Adjudication procedure, Judicial decisions, Legal aspects, Piers.

In a condemnation proceeding, a county sought to acquire title to certain property held as an easement in common by all the citizens of a city. The county commissioners determined that the easements were valueless, and defendants objected. The appropriated land was to be used as a site for wharves for the protection of the shoreline. The Supreme Court of Monroe County held that the easements had already become public in nature, so defendants lost nothing in the condemnation. The condemnation was, however, termed a technical taking and nominal damages were awarded. (Barker-Florida)
W70-10449

ALOTTO V CITY OF CORNING (CAUSE OF ACTION FOR CONTINUING WATER DAMAGE).
258 App Div 932, 16 NYS 575-576 (1939).

Descriptors: *New York, *Sewers, *Water injury, *Jurisdiction, Overflow, Local governments, Cities, Municipal wastes, Sewage, Sewage disposal, Legal aspects, Judicial decisions, Structures, Disposal, Administration, Management, Roads, Road construction, Remedies.

Plaintiff landowner brought action for damages allegedly caused by overflow from defendant city's sewers. Plaintiff contended that the sewers became inadequate to dispose of water and noxious materials as a result of a change in grade of defendant's street. The lower court dismissed the complaint as not stating a cause of action. The Supreme Court of New York reversed. A court of equity will recognize a cause of action to restrain a continuing invasion of property rights and will retain jurisdiction for determination of past damages. (Dye-Florida)
W70-10450

MORETTI V VILLAGE OF PEEKSKILL (DIVERSION OF STREAMFLOW).
12 NYS2d 687 (App Div 1939).

Descriptors: *New York, *Streamflow, *Natural flow, *Alteration of flow, Judicial decisions, Streams, Diversion, Floods, Surface runoff, Lakes, Surface waters, Watersheds (Basins), Flood damage, Local governments, Damages, Overflow, Running waters, Water injury, Legal aspects, Small watersheds, Snow, Snowmelt, Snow management, Melt water.

Plaintiff brought action against defendant village for damages to his house caused by the overflow of a stream running through his property. Plaintiff contended that defendant diverted the waters of a lake from their natural course and deposited them in the stream running through plaintiff's property, knowing that there was no sufficient outlet for such extra water. Plaintiff also contended that defendant deposited a large quantity of snow in the area surrounding plaintiff's stream, causing it to overflow. The Supreme Court of New York reversed the trial court's judgment for plaintiff. Plaintiff's own evidence showed that the lake from which the water was diverted was within the drainage area of the stream running through plaintiff's property. Diversion of the waters of the lake would thus have little effect on plaintiff's stream. (Dye-Florida)
W70-10451

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (DAMAGES FOR SUBMERGED SAND INJURY).
256 App Div 582, 11 NYS2d 459-462 (1939).

Descriptors: *New York, *Damages, *Water pollution effects, *Dredging, Water pollution, Pollution abatement, Riparian rights, Soil contamination effects, Wastes, Fouling, Judicial decisions, Islands, Legal aspects, Bays, Erosion, Cities, Local government, Beds, Rivers, Navigable waters, Beds under water, Adjudication procedure.

Plaintiff owned an island in a navigable river and had, through dredging performed by a licensee, created a substantial bay or cove thereon. Defendant city deposited sewage in the river, thereby decreasing the value of the island and damaging the sand on the bed of the cove. Plaintiff sought damages and injunctive relief. Plaintiff contended that his damages should include the decreased value of the submerged sand and gravel and submitted evidence proving the amount of sand damaged and its value. The trial court awarded plaintiff damages for the decreased rental value of the island and the value of the ruined sand. On appeal defendant contended that plaintiff's lack of a license to dredge from the river rendered the sand valueless to plaintiff for purposes of sale. The Supreme Court of New York agreed, holding that plaintiff had the burden of proving a right to dredge sand before he was entitled to damages for injury thereto. Damages were awarded for decreased rental value alone. (Dye-Florida)
W70-10452

ROBINS ISLAND CLAM CO V GAFFGA (PROPERTY INTEREST IN CLAMS).
170 Misc 362, 8 NYS2d 969-970 (1938).

Descriptors: *New York, *Fisheries, *Clams, *Commercial shellfish, Oysters, Shellfish, Storms, Legal aspects, Judicial decisions, Hurricanes, Damages, Winds, Public rights, Commercial fishing, Fish harvest, Marine fisheries, Migration, Relative rights, Public rights, Public lands.

Plaintiff clam company planted clams on its property. Evidence indicated that the clams were removed from plaintiff's property by a severe storm. Plaintiff sought to restrain defendants from removing clams from property adjacent to plaintiff's land. Defendant contended that clams found on public lands may be reduced to possession by anyone, and that any property plaintiff may have had in the clams was lost when they were shifted to public lands. The Supreme Court of New York held for plaintiff. Evidence showed that for a significant period no clams had been found on the land now occupied by the clams in question. Clams are not capable of moving themselves. Thus the clams must have been moved by an act of God. It has been held that at least a qualified right of property may be obtained in oysters. The same is true of clams. Plaintiff was not divested of his property right in the clams by their movement. The court issued a 30-day injunction restraining removal of clams from the area within 150 feet west of plaintiff's property. (Dye-Florida)
W70-10453

IN RE JAMAICA BAY (CONDEMNATION OF SUBMERGED LANDS).
255 App Div 992, 8NYS2d 300 (1938).

Descriptors: *New York, *Beds, *Condemnation, *Condemnation value, Eminent domain, Legal aspects, Real property, Compensation, Judicial decisions, Governments, Local governments, Cities, Administration, Docks, Wharves, Roads.

Petitioner city sought to condemn lands under water which defendants claimed to own. The lower court found that title to the lands was in defendants and set the award. Both parties appealed. The Supreme Court of New York affirmed without comment. (Dye-Florida)
W70-10454

CITY OF NEW YORK V SWIFT AND CO (RIPARIAN RIGHT OF ACCESS TO WATER NOT SUBJECT TO RENT BY CITY OWNING RIVER BOTTOM).
162 Misc 561, 294 NYS 209-211 (1936).

Descriptors: *New York, *Riparian rights, *Access routes, *Rent, Cities, Local governments, Riparian land, Riparian waters, Navigable waters, Right-of-way, Regulation, Ownership of beds, Navigable rivers, Public rights, Docks, Leases, Compensation, Judicial decisions, Legal aspects, Relative rights.

Plaintiff city brought action against defendant riparian owner to recover the reasonable rental value of submerged land belonging to the city, over which defendant had constructed and maintained a freight platform. Plaintiff contended that it had the absolute right to improve the water front for navigation and therefore was entitled to exact rent from anyone using the waterfront. Defendant argued that, as an upland riparian owner, he had a right of access to the navigable water in front of his land. The court noted that although plaintiff's ownership of the river bottom was conceded, it did not appear that the city was exercising its right of improvement, and defendant's riparian right of access should therefore be respected. The court held that the maintenance of the freight platform was a reasonable exercise of defendant's riparian right and entered a judgement for defendant. (Liptak-Florida)
W70-10455

ELDRED DRAINAGE AND LEVEE DIST V WILCOXSON (DRAINAGE DISTRICT'S AUTHORITY TO LEVY AN ASSESSMENT TO PAY A JUDGMENT FOR DAMAGES).
365 Ill 249, 6 NE2d 149-152 (1936).

Descriptors: *Illinois, *Drainage districts, *Assessments, *Damages, Drainage systems, Taxes, Local governments, Legislation, Compensation, Real property, Administration, Ditches, Legal aspects, Judicial decisions, Condemnation, Eminent domain, Flood damage, Water injury, Remedies, Administrative agencies.

Plaintiff drainage district sought an assessment against defendant property owners to pay a judgment which had been rendered against plaintiff for flood damage to another property owner's land caused by the construction of a drainage ditch. Defendants objected to the assessment, contending that no assessment could be levied on property which received no benefit from the levy, and that the district had no authority to levy for the payment of a judgment in favor of another property owner. Affirming a judgment for plaintiff, the court held that the statutory restriction of assessments to property subject to benefit from the levy only applied to the original cost of an improvement, not subsequent obligations of the district. The court further noted that since the injured property owner had a constitutional right to compensation, the district must have had the authority to levy for the satisfaction of the judgment because the district had no other means of raising funds. (Liptak-Florida)
W70-10456

GEORGIA POWER CO V FEDERAL POWER COMM'N (LICENSING OF HYDROELECTRIC POWER PLANT).
152 F2d 908-914 (5th Cir 1946).

Descriptors: *Georgia, *Dams, *Federal Power Act, *Hydroelectric plants, Judicial decisions, Legal aspects, Hydroelectric project licensing, Hydroelectric power, Navigable waters, Permits, Rivers, Federal government, Non-navigable waters, Navigable rivers, Power head, Power plants, Reservoirs, Regulation, Administrative agencies, Administrative decisions.

Plaintiff power company proposed to build a hydroelectric power plant at a dam to be built by it on an allegedly non-navigable portion of a Georgia river. Intention of such was filed with the Federal Power Commission in accordance with the Federal Power Act. The Commission held hearings to determine if the construction of the plant would affect commerce on the navigable waters of the United States. The Commission decided that the project would affect interstate commerce and ordered plaintiff to apply for a license in accordance with the terms of the Federal Power Act. Plaintiff

sought reversal of the Commission's order, alleging that the provisions of the Federal Power Act did not apply to projects located on a non-navigable part of a stream. The court, relying on factual testimony of the commercial nature and use of the river and the definition of navigable waters as being those which are susceptible of being used in their ordinary condition (or by the means of artificial aids) as highways for commerce, affirmed the Commission's order requiring plaintiff to comply with and be licensed under the Federal Power Act. (Barnett-Florida)
W70-10457

NIAGARA FALLS POWER CO V FEDERAL POWER COMM'N (DIVERSION OF WATER FROM RIVER BY POWER COMPANY).
137 F2d 787-797 (2nd Cir 1943).

Descriptors: *Hydroelectric power, *Financing, *Diversions, *Administrative agencies, Alteration of flow, Diversion structures, Administrative decisions, Federal jurisdiction, Federal Power Act, Rivers, Treaties, Judicial decisions, Legal aspects, Capital, Jurisdiction.

Plaintiff power company, which operated a hydroelectric project on the Niagara River, sought to set aside orders of the Federal Power Commission reducing plaintiff's capitalization. The court affirmed defendant's orders, noting that any diversion of water from the Niagara River by plaintiff was subject to the authority of the Federal Power Commission. (Hart-Florida)
W70-10458

ALABAMA POWER CO V FEDERAL POWER COMM'N (FEDERAL POWER COMMISSION'S DETERMINATION OF HYDROELECTRIC PROJECT COSTS).
128 F2d 280-296 (DC Cir 1942).

Descriptors: *Alabama, *Hydroelectric power, *Federal Power Act, *Administrative agencies, Federal jurisdiction, Water resources development, Hydroelectric project licensing, Financing, Hydroelectric plants, Capital, Capital costs, Electric power costs, Electric power rates, Expenditures, Financial analysis, Permits, Judicial decisions, Legal aspects, State governments.

Plaintiff power company brought action to set aside orders of defendant commission determining the original cost of plaintiff's hydroelectric project. In a lengthy opinion primarily discussing financing, accounting methods and the authority of defendant to review plaintiff's accounts, the court noted that the privilege of exploiting the water resources of navigable streams is granted only by statute, and may be made subject to conditions appropriate to safeguard the public interest. The court then found that plaintiff, having received its license subject to these statutory limitations, could not avoid the comprehensive and inclusive powers of defendant. The prior judgment for defendant was affirmed. (Hart-Florida)
W70-10459

MAJOR AND CITY COUNCIL OF BALTIMORE V CROWN CORK AND SEAL CO (BOUNDARY LINES IN WATERS OF NAVIGABLE RIVER).
122 F2d 385-393 (4 Cir 1941).

Descriptors: *Maryland, *United States, *Cities, *Riparian rights, Navigable rivers, Docks, Boundaries (Property), Judicial decisions, Legal aspects, Riparian land, Landfills, Ownership of beds, Beds under water, Remedies, Airports, Navigable waters, Federal government, State governments, Boundary disputes, Local governments, Regulation.

The harbor engineer for the City of Baltimore, pursuant to state law and city ordinance, drew divisional lines into the waters of the Patapsco River, extending from property owned by the city and an adjoining corporation. These lines were utilized to delineate areas wherein the city and the corporation were entitled to exercise their respective riparian rights. The city airport was erected according to these lines and the corporation was required to adhere to them in erecting improvements on filled land in the river. A controversy arose between the city and the corporation as to the proper location of the division lines. The city wanted to abandon the existing lines and establish new ones, appropriating part of the corporation's lands. The trial court held for plaintiff corporation, finding that defendant city was estopped to deny the original divisional lines as being the proper ones since it had exercised rights otherwise inconsistent with the proposed change. The appellate court affirmed in part and reversed in part, limiting the holding to apply only as to the corporation before the court and not as against other riparian owners whose divisional lines had not yet been determined. (Barnett-Florida)
W70-10460

THE SS NEA HELLIS (VIOLATION OF OIL POLLUTION ACT).
116 F2d 803-806 (2nd Cir 1941).

Descriptors: *United States, *Oily water, *Admiralty, *Water pollution, Legislation, Oil wastes, Federal government, Remedies, Harbors, Oil, Judicial decisions, Legal aspects, Ships, State governments, Navigable waters, Tidal waters, Regulation, Fishing, Rivers and Harbors Act.

The United States brought libel in admiralty against a steamship to collect a penalty for violation of the federal Oil Pollution Act of 1924 for the discharge of oil into the coastal waters of the United States. Exceptions filed to the libel were sustained in the trial court. The court agreed with libelee that no proper allegations were put forth charging a violation of the Act. The Circuit Court of Appeals, Second Circuit, reversed, holding that although insufficient allegations were made to sustain the libel under the Act of 1924, those made were sufficient to charge a violation under the New York Harbor Act of 1888 which forbade the 'discharge of any matter into the tidal waters of the New York Harbor'. In light of a provision in the 1924 act stating that it was in no way to be construed as modifying or repealing any prior act, the court reasoned that there could be no argument that the Act of 1888 was not controlling. The two statutes were found to be complimentary in their effect and provided adequate relief for the violations alleged. (Barnett-Florida)
W70-10461

DOLLAR SS CO V UNITED STATES (DISCHARGE OF REFUSE INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 05B.
W70-10462

CUNNINGHAM V SKIRIOTES (VALIDITY OF MARINE BOUNDARY EXCEEDING THE INTERNATIONAL LIMIT AS AGAINST A FLORIDA CITIZEN).
101 F2d 635-637 (5th Cir 1939).

Descriptors: *Florida, *International law, *Commercial fishing, *Marine animals, Legislation, International waters, Tidal water, Ownership of beds, Beds under water, Navigation, Navigable waters, Wildlife conservation, Judicial decisions, Legal aspects, State jurisdiction, Jurisdiction, Reservation doctrine, Regulation, Supervisory control (Power).
Identifiers: *Sponges.

Plaintiff sheriff, for the state of Florida, appealed a decision of a federal district court which granted a habeas corpus petition of defendant sponge-diver who was charged with illegally taking sponges with diving apparatus. Defendant contended the jurisdictional limit of Florida is fixed by international law at three miles, and that since he was diving without this limit, Florida had no jurisdiction over him. Plaintiff asserted that the state had jurisdiction to its nine mile marine boundary. Finding that the state owned all tidewater beds within its jurisdiction, subject to the Congressional right to regulate navigation, the court concluded that Florida could regulate sponge-taking. The court agreed that international law fixed Florida's boundary at three miles, but also noted that the Florida limit of nine miles was equally valid as against Florida citizens, and thereby concluded that defendant could not question his own sovereign's boundary. The judgment of the lower court was reversed. (Hart-Florida)
W70-10463

SOUND MARINE AND MACHINE CORP V WESTCHESTER COUNTY (INTERFERENCE WITH NAVIGATION RIGHTS BY SEWER PIPE).

100 F2d 360-363 (2nd Cir 1938).

Descriptors: *New York, *Admiralty, *Pipelines, *Navigation, Riparian rights, Sewers, Pipes, Governments, Local governments, Federal government, Permits, Navigable waters, Channels, Riparian waters, Non-consumptive use, Relative rights, Remedies, Adjudication procedure, Judicial decisions, Jurisdiction, Federal jurisdiction, Legal aspects, Damages.

Plaintiff riparian landowner brought an action in admiralty to enjoin defendant from interfering with plaintiff's right to navigate on waters adjacent to plaintiff's property. Defendant had laid a sewer pipe across a channel adjacent to plaintiff's property and had thus decreased the low water depth, making it impossible for certain craft to use the channel in order to reach plaintiff's boat yard. Defendant argued that it was authorized to lay such pipe by permits from the War Department and the State of New York. The United States Circuit Court of Appeals, Second Circuit, ruled that admiralty jurisdiction was properly sought by the plaintiff since the injury complained of dealt with something intimately associated with the sea and navigation. The court remanded the case to the trial court for determination on the merits, adding that injunction is not a proper admiralty remedy and that the plaintiff should seek damages. (Barker-Florida)
W70-10464

HEID V ALLEGHENY COUNTY (DAMAGES FROM DIVERSION OF SURFACE WATER FLOW BY HIGHWAY IMPROVEMENTS).
122 Pa Super 312, 186 A 215-217 (1936).

Descriptors: *Pennsylvania, *Surface drainage, *Flood damage, *Eminent domain, Drainage water, Drainage, Surface runoff, Overland flow, Damages, Flooding, Highways, Roads, Judicial decisions, Floods, Flow, Natural flow, Drainage effects, Condemnation, Diversion.

In an action for damages, it was established that the state highway department in resurfacing a road had diverted the natural flow of surface water and turned it upon plaintiff's land. Plaintiff contended that the defendant county, as agent for the state, was liable for such damages. Defendant contended that, inasmuch as no actual entry had been made by the highway department upon the land, any damages caused by the improvement of the road were merely consequential and did not require compensation. The court agreed with defendant, holding that the turning of the water upon plaintiff's land was not a direct entry and thus gave rise to only consequential damages. The plaintiff was not entitled to recovery. (Snow-Florida)
W70-10465

IN RE OPINION OF THE JUSTICES (PUBLIC PURPOSE REQUIREMENT FOR CONSTRUCTION OF DAM WITH PUBLIC FUNDS).
190 A 425-431 (NH 1937).

Descriptors: *New Hampshire, *Public benefits, *Electric power, *Project purposes, Dams, Utilities, Structures, Flood control, Electric power industry, Public rights, Governments, State governments, Legal aspects, Judical decisions, Projects, Engineering structures, Financing, Costs, Taxes, Repayment contracts.
Identifiers: *Public purpose.

In an advisory opinion to the governor, the Supreme Court of New Hampshire ruled upon the constitutional validity of an act authorizing the pledge of the state's full faith and credit. The pledge was to guarantee the payment of bonds issued to construct a privately operated dam on the Connecticut River. The court ruled that the act was valid in that the pledge of credit was for a public purpose as required by the constitution. Public purpose was found because electric power and flood control protection would be provided to the people of the area. (Snow-Florida)
W70-10466

LEARY V CITY OF MANCHESTER (PUBLIC PURPOSE REQUIREMENT FOR THE EXERCISE OF THE POWER OF EMINENT DOMAIN).

21 A2d 156-160 (NH 1941).

Descriptors: *New Hampshire, *Condemnation, *Easements, *Project purposes, Ditches, Drainage, Eminent domain, Judicial decisions, Legal aspects, Local governments, Governments, Public rights, Compensation, Maintenance, Maintenance costs.
Identifiers: *Public purpose.

In an action for declaratory judgment to determine whether the defendant municipality could acquire by condemnation the full title to property in which it already had an easement, plaintiff contended that the taking would not be for an authorized public purpose. The defendant, having an easement to build a drainage ditch across plaintiff's land--conditioned upon proper maintenance of the ditch, contended that the expense of such maintenance was greater than the value of the property. Therefore, defendant argued, condemnation should thus be available so as to promote public economy. The court held that public economy was a matter of general welfare and, as such, was a public purpose for which the power of eminent domain could be exercised. Defendant could condemn the land. (Snow-Florida)
W70-10467

UNITED STATES V CERTAIN LANDS IN TOWN OF HIGHLANDS (OWNERSHIP OF POND BED).

52 F Supp 540-550 (SD NY 1943).

Descriptors: *New York, *Ownership of beds, *Boundaries (Property), *Boundary disputes, United States, Condemnation, Land tenure, Real property, Ponds, Beds, Beds under water, Lake beds, Governments, Judicial decisions, Legal aspects, State governments, Non-navigable waters.

In a condemnation suit, the United States sought to acquire land which surrounded a small lake. The issue to be determined by the court was whether title to upland fronting on a non-navigable body of water included title to the land under the water. The State of New York claimed title to the lake by escheat, arguing that the original owners of the upland had failed to specifically mention the title to the pond when the land was transferred. The United States District Court, Southern District of New York, ruled that grants of land surrounding a non-navigable body of water convey ownership of the land under water. Therefore, the state had no claim of ownership in the pond. (Barker-Florida)
W70-10468

LUCAS V CITY OF LOUISIANA (FLOOD DAMAGE CAUSED BY CITY'S NEGLIGENT FAILURE TO REMOVE OBSTRUCTION IN STREAM).
173 SW2d 629-636 (Mo Ct App 1943).

Descriptors: *Missouri, *Overflow, *Obstruction to flow, *Damages, Flood damage, Walls, Banks, Cities, Floods, Land tenure, Bridges, Streams, Legal aspects, Legislation, Construction, Structures, Rainfall, Local governments, Channel flow, Judicial decisions, Drainage, Surface runoff, Flood control, Natural streams.

Defendant city had constructed a stone wall along the banks of a stream flowing through plaintiff's property. The wall later collapsed, blocking the stream, which overflowed after a severe downpour and damaged plaintiff's bridge and other property. Plaintiff presented evidence that the city had negligently constructed the wall, and had negligently allowed it to obstruct the stream flow for some time before the flood. The court held that as the city had adopted the natural watercourse as a drainage outlet, it had a duty to keep the watercourse clear. The fact that no ordinance authorized construction of the statute was held not to obsolve the city from liability. (Caldwell-Florida)
W70-10469

CITY OF LOUISVILLE V COPE (LIABILITY FOR FLOOD DAMAGE CAUSED BY WATER BACKING UP FROM CITY'S STORM DRAIN).
296 Ky 207, 176 SW2d 390-393 (1943).

Descriptors: *Kentucky, *Subsurface drains, *Flood damage, *Backwater, Cities, Obstruction to flow, Floods, Rainfall, Drainage systems, Local governments, Streams, Overflow, Storm drains, Construction, Legal aspects, Judicial decisions, Sewers, Maximum probable flood, Water injury.

Plaintiff landowners brought action for damages against defendant city, claiming that their residences were periodically flooded by backwater from the city's storm drain. The backwater was allegedly caused by a bottleneck in the drain below plaintiffs' lands. Defendant claimed that plaintiffs were quilty of contributory negligence in failing to install backwater valves which would have prevented water from backing up into their residences. The court stated that where a city undertakes to establish drainage and sewer systems, it is under a duty to construct a system adequate to carry off ordinary amounts of rainfall. The fact that the residences were built after the sewer and 'came to the drain' was held not to absolve defendant from liability. Evidence by plaintiffs that backwater valves would not have prevented the damage overcame defendant's contention of contributory negligence, and the lower court's decision for plaintiffs was affirmed. (Caldwell-Florida)
W70-10470

CITY OF PHILADELPHIA V STANDARD OIL CO (RIGHT TO USE OF A BULKHEAD RETAINING WALL).
12 F Supp 647-651 (ED Pa 1934).

Descriptors: *Pennsylvania, *Riparian land, *Bulkheads, *Retaining walls, Low water mark, Riparian rights, Navigation, Docks, Shores, Rivers, Dredging, Ships, Basins, Silting, Judicial decisions, Legal aspects, State governments, River beds, Access routes, Eminent domain.

Defendant was an owner of riparian land within the Philadelphia city limits. Plaintiff city, acting in accord with state law, built a retaining structure along the low water mark in front of defendant's property as part of a 5 mile project to aid navigation. Defendant dredged the river bottom in front of its property to create a ship basin. Plaintiff contended that this basin could not be maintained without the aid of the bulkhead and as a result, defendant was violating a Pennsylvania law which prohibited riparian owners from using such structures for wart purposes without paying the proportionate cost thereof. The court held that the right of free access to navigable water by a riparian landowner includes the right to dredge the channel in front of such land. The city had the right to build the structure as a public improvement, but the Pennsylvania constitution proscribes the assessment of an individual property owner for the cost of improvements for the general public benefit. (Barnett-Florida)
W70-10471

PETRABORG V ZONTELLI (RIPARIAN RIGHT TO USE AND ENJOYMENT OF ENTIRE LAKE).
15 NW2d 174-184 (Minn 1944).

Descriptors: *Minnesota, *Lakes, *Riparian rights, *Riparian land, Recreation, Fishing, Dams, Severance, Boating, Swimming, Drainage systems, Pipelines, Reasonable use, Judicial decisions, Legal aspects, Navigable waters, Lake beds, Boundaries (Property), Mining, Wastes, Relative rights.

Plaintiff riparian landowner brought suit to enjoin the building of a dam and the drainage of a section of a navigable lake by defendant mining company. Plaintiff operated a resort on the western side of the lake, using said lake for boating, hunting, fishing and other recreational purposes in the proper exercise of his riparian rights. Defendant's drainage operations were to take place on the eastern section of the lake. The lake was divided into two sections, connected by a narrow portion of the lake. Defendant argued that this physical attribute of the lake made each section a separate lake, and thus his acts in no way violated plaintiff's riparian rights. Plaintiff argued that defendant's acts were a deprivation of those riparian rights without proper compensation or due process of law. The court affirmed the lower court's issuance of a permanent injunction against defendant, finding that defendant's acts would constitute a trespass and damage plaintiff's riparian rights. The court held that the lake was to be considered one lake, and defendant's acts would have deprived plaintiff of the use of that portion of the lake which all riparian owners were entitled to share equally. (Barnett-Florida)
W70-10472

TESENEER V HENRIETTA MILLS CO (RIGHT TO RECOVER PERMANENT DAMAGES FOR NEGLIGENT OPERATION DAM).
209 NC 615, 184 SE 535-540 (1936).

Descriptors: *North Carolina, *Deposition (Sediments), *Dams, *Streambeds, Damages, Beds, Land, Sands, Silts, Legal aspects, Judicial decisions, Real property, Operations, Engineering structures, Fertility, Soil properties, Crop production, Water injury, Easements, Flooding, Regulation, Backwater.
Identifiers: Debris.

Plaintiff riparian landowner brought action against defendant corporation for recovery of permanent damages to his land which resulted from the negligent operation of defendant's power dam, which was located about one mile below plaintiff's land. Plaintiff contended that silt, sand and debris were deposited upon twenty acres of fertile river bottom land. He further alleged that these deposits upon his land were caused by the negligent operation of defendant's dam and that such land was no longer suitable for crop production. Defendant dam owner denied such contentions and argued that the operation of its dam had always been proper. The court found plaintiff's allegations were sustained by the evidence and awarded him permanent damages. However, the court also granted defendant dam owner an easement to backwater and deposit silt and sand upon the twenty acres of plaintiff's land for which permanent damages had been granted. (Finman-Florida)
W70-10473

JOHN H HEALD CO V CHESAPEAKE AND O RY (TERMINATION OF LEASE INVOLVING WATER RIGHTS DISCHARGES ALL SUCH RIGHTS).

190 SE 325-328 (Va 1937).

Descriptors: *Virginia, *Canals, *Water users, *Leases, Water supply, Water contracts, Water demand, Railroads, Judicial decisions, Legal aspects, Water rates, Water rights, Public rights, Usufructuary right, Contracts.
Identifiers: Private rights.

Defendant railway company owned a canal which provided water to plaintiff corporation under a lease agreement. Subsequently, defendant agreed to sell its canal properties to a third party upon the condition that all public duties connected with the canal be discharged. Defendant had such public duties discharged in the manner prescribed by law. Furthermore, in conformity with the terms of its lease with plaintiff water user, defendant canal owner served notice of his intention to terminate such lease and discontinue the water supply. Plaintiff sought an injunction restraining defendant from discontinuing the water supply on the ground that plaintiff had a private right to the perpetual and undiminished supply of water at reasonable rates. The court held for defendant canal owner and stated that plaintiff water user had no right to the use of canal water beyond that specified in the lease. (Finman-Florida)
W70-10474

CONNER V JARRETT (BOUNDARY IMPLIED TO RUN TO CENTER OF STREAM).

200 SE 39-46 (W Va 1938).

Descriptors: *West Virginia, *Boundaries (Property), *Boundary disputes, *Real property, Land, Streams, Banks, Non-navigable waters, Judicial decisions, Legal aspects, Relative rights, Standards, Implied benefits, Grants.

Plaintiff brought an action of ejectment against defendant involving a small lot which bordered a stream. Plaintiff's deed called for the boundary line of such lot to run from a given point to a stake on the bank of a non-navigable stream. From that point the line was described to run up the stream by courses and distances, which closely corresponded to the course of the stream. Plaintiff contended that his boundary line should be held to follow the center of the stream. Defendant insisted that plaintiff's boundary line should be determined by the courses and distances called for in the deed. The court held for plaintiff, following the general proposition that where a boundary line ran to a point on a non-navigable stream, such description of the line implied that the line should follow the stream at its center unless the grant clearly excluded such construction. (Finman-Florida)
W70-10475

SOUTHLAND COFFEE CO V CITY OF MACON (LIABILITY FOR DAMAGES RESULTING FROM EXTRAORDINARY RAINFALL).
3 SE2d 739-744 (Ga Ct App 1939).

Descriptors: *Georgia, *Flooding, *Sewers, *Precipitation excess, Rainfall, Drainage systems, Drains, Cities, Damages, Rain, Rainfall intensity, Storms, Winds, Flood damage, Flood control, Obstruction to flow, Drainage water, Abatement, Legal aspects, Judicial decisions, Absorption, Intakes, Rainfall-runoff relationships.

Plaintiff company brought suit against defendant city to recover damages which resulted from the flooding of plaintiff's premises shortly after a severe rainstorm. Plaintiff alleged defendant maintained an inadequate storm sewerage system near his premises which constituted a continuing, abatable nuisance. Furthermore, plaintiff contended that defendant was negligent in failing to take necessary steps to correct the known inadequacy of the system. Defendant claimed that plaintiff's damages resulted from an extraordinary downpour of rain caused by an act of God. The court held for defendant, finding plaintiff's damages to have been caused by an extraordinary rainfall which resulted in the sewerage system being taxed beyond reasonable expectation. The court further found that as a result of the heavy rains and high winds, accumulation of debris in the streets had interfered with the normal process of absorption by intake basins and sewers. (Finman-Florida)
W70-10476

JOHNSTON V CITY OF ATLANTA (MUNICIPALITY NOT LIABLE FOR ERROR OF JUDGMENT IN SEWER SYSTEM PLANNING).
31 SE2d 417-419 (Ga Ct App 1944).

Descriptors: *Georgia, *Disposal, *Sewers, *Drainage systems, Surface waters, Sewage, Cities, Construction, Drainage water, Surface drainage, Judicial decisions, Legal aspects, Channels, Drains, Surface runoff.

Defendant municipality constructed a sewer system pursuant to a general drainage plan. A portion of this system consisted of an opening or an inlet into a sewer through which surface waters flowed. A water-trap or catch basin was constructed on three sides of the sewer opening which guided surface waters into the sewer. Subsequently, defendant eliminated the three-sided catch basin and placed a grate or grill over the sewer opening. Plaintiff contended defendant was negligent in changing the opening into the sewer as the new construction did not adequately channel surface waters to the sewer opening. The court stated that the duties of municipal authorities in adopting a general drainage plan involved the exercise of deliberate judgment and wide discretion. The court found for defendant, and held that a municipality is not liable for an error of judgment on the part of its officials in locating or planning improvements to its general system of drainage sewers. (Finman-Florida)
W70-10477

HASER V ALLEGHENY COUNTY (CONDEMNATION PROCEEDING TO CHANGE LOCATION OF A CREEK BED).
185 A 763-764 (Pa 1936).

Descriptors: *Pennsylvania, *Streambeds, *Diversion, *Eminent domain, Condemnation, Beds, Streams, Routing, Judicial decisions, Highways, Roads, Beds under water, Channels, Overflow, Remedies, Damages, Compensation, Local government, State governments, Legislation, Construction.

In a state highway condemnation proceeding, plaintiff contended that defendant county was liable for damages to his property resulting from a change of the location of a creek bed. When the creek bed was straightened and moved to facilitate the construction of a highway, the bed occupied a considerably larger portion of plaintiff's property than it had prior thereto. Defendant contended that it was immune from suit in that only consequential damages, which do not require compensation, were involved. The court held for plaintiff, stating that the legislation authorizing the construction of the highway specifically made the county liable for damages in such a situation. (Snow-Florida)
W70-10478

JANSKY V CITY OF TWO RIVERS (OWNERSHIP OF LAKE RELICTION).
278 NW 527-533 (Wis 1938).

Descriptors: *Wisconsin, *Accretion (Legal aspects), *Boundaries (Property), *Cities, Lake Michigan, Lakes, Land tenure, Real property, Riparian waters, Riparian rights, Prescriptive rights, Riparian land, Legal aspects, Judicial decisions, Highways, Roads, Boundary disputes.

Plaintiff riparian landowner brought action against defendant city and other riparian owners to quiet title to property created by reliction. Plaintiff owned two lots bordering upon Lake Michigan; defendant city's street terminated at the lake. The lake had receded 425 feet from the original waterline. Plaintiff claimed ownership of the reliction between his lots and the new waterline. Defendant contended that the reliction had been used during the prescriptive period as a public highway, and therefore plaintiff had no riparian ownership. Evidence showed that the street ended at the lake with a stone wall, barricade, and danger sign; the court held this evidence disproved the use of the reliction as a public highway. Finding that plaintiff's title gave him riparian ownership, the court apportioned the reliction between the several owners, including defendant city by drawing a straight line perpendicular to the new shoreline from the intersection of the riparian owners' division lines and the old shoreline. (Hart-Florida)
W70-10479

IN RE BD OF SUPERVISORS (DETERMINATION OF LAKE'S NATURAL WATER LEVEL BY A COURT).
For primary bibliographic entry see Field 02H.
W70-10480

MEYERS V LAFAYETTE CLUB (RIPARIAN OWNER'S RIGHT TO DRAW LAKE WATER FOR SPRINKLING: REASONABLENESS OF USE).
266 NW 861-867 (Minn 1936).

Descriptors: *Minnesota, *Riparian rights, *Reasonable use, *Irrigation water, Navigable waters, Lakes, Riparian land, Water levels, Judicial decisions, Damages, Natural use, Domestic water, Legal aspects, Relative rights, Recreation, Diversion, Consumptive use.

Plaintiff riparian owners sought to enjoin defendant golf club from drawing water from a lake on which defendant was also a riparian owner. Plaintiffs contended that the lake's water level was being diminished by defendant club's use. Defendant contended that its use of the lake water for sprinkling its riparian land was a reasonable domestic use which did not substantially reduce the water level. The Supreme Court of Minnesota held that as long as there was no substantial damage to other riparians or to the public interest, defendant club had the right to make a reasonable use of the lake water for domestic purposes or for proper upkeep of its riparian land. (Quesada-Florida)
W70-10481

LAMPREY V AMERICAN HOIST AND DERRICK CO (TITLE TO ACCRETION).
For primary bibliographic entry see Field 02J.
W70-10482

NICHOLS V CITY OF MORRISTOWN (LIABILITY FOR INJURY DUE TO INADEQUACY OF CREEK TO ACCOMMODATE SURFACE WATER).
For primary bibliographic entry see Field 02E.
W70-10483

MARCHAND V MARCHAND FERRY CO (PUBLIC RIGHTS TO LANDING ON PRIVATE PROPERTY ADJOINING A NAVIGABLE STREAM).
51 D and C 79, 7 Fay L J 37-40 (Pa C P 1944).

Descriptors: *Pennsylvania, *Public rights, *Highways, *Docks, Navigable waters, Navigable rivers, Relative rights, Real property, Riparian rights, Roads, Easements, Right-of-way, Legal aspects, Rivers, Transportation, Access routes, Land tenure.

Plaintiffs owned riverfront property across which ran a public highway ending at the water's edge.

Defendant ferry company had for a long period leased the property from plaintiffs for use as a ferry landing. Defendants refused to pay further rent and were ejected. Defendants sought to open the judgment in ejection on the grounds that the ferry landing was part of a public highway and, as such, was open to use by all. The court disagreed. Although a public highway had been constructed on the banks of a navigable stream, the public acquired only a right to passage over the highway. The use of the landing was an additional servitude for which users were required to compensate the owners of the property. (Dye-Florida)
W70-10484

CIMINELLI V LIBURDI (FLOOD DAMAGE RESULTING FROM GRADE CHANGE BY ADJOINING LANDOWNERS).
47 Lac Jur 31-32 (Pa C.P. 1942).

Descriptors: *Pennsylvania, *Flooding, *Relative rights, *Land use, Real property, Judicial decisions, Channels, Graded, Surface drainage, Surface waters, Runoff, Surface runoff, Reasonable use, Competing uses, Diversions, Land, Drainage, Grading, Adjudication procedure, Riddance (Legal aspects), Diversion, Natural flow.

Plaintiff sought relief from flooding of his property caused by a change in grade of defendant's adjoining property. Defendant contended that plaintiff's bill contained insufficient allegations to support it. The Court of Common Pleas of Lackawanna County sustained the objection, but gave plaintiff leave to amend. Every man has the right to full use of his property. If, through non-negligent use, a landowner's neighbor is harmed, the neighbor has no grounds for relief. However, where a landowner cuts an artificial channel which causes waters to be concentrated and discharged with greater than usual force onto another's land, he is liable. A complaint to be sufficient must allege the cutting of such a channel. (Dye-Florida)
W70-10485

MCNEELY AND PRICE CO V PHILADELPHIA PIERS, INC (CONTROL OVER WHARFAGE TARRIFS).
196 A 846-861 (Pa 1938).

Descriptors: *Pennsylvania, *Docks, *Tariff, *Federal jurisdiction, Regulation, Coastal structures, Piers, Federal government, Judicial decisions, Tidal waters, Relative rights, Administrative agencies, Governments, State governments, State jurisdiction, Assessments, Foreign trade.

Plaintiff, a shipper in foreign commerce, sought to enjoin defendant wharf owners from imposing a fee upon shippers for the privilege of using their wharf. The plaintiff contended that such a fee could not be imposed because such had not been approved by the state's Public Utility Commission. Defendants contended that the Public Utility Commission was without jurisdiction to approve wharfage charges because such regulation was within the sole power of the federal government in the regulation of commerce. The court held that wharfage charges were matters falling within the federal government's commerce power and that Congress had preempted the area by passing legislation to the effect that states were without authority to regulate the same. The court also rejected plaintiff's contention that lands bordering on tide water were subject to the regulation by the states alone. The court ruled that this is the case when commerce is not involved, but when regulation of commerce is involved, then the federal government has plenary power. The injunction was denied. (Snow-Florida)
W70-10486

GARRISON V ENGLE (OWNERSHIP OF SUBMERGED LANDS WHERE HIGH WATER MARK HAS CHANGED).
193 A 820-824 (NJ Ch 1937).

Descriptors: *New Jersey, *High water mark, *Ownership of beds, *Boundaries (Property), Navigable waters, Riparian waters, Riparian land, Riparian rights, Relative rights, Boundary disputes, Shores, Beds, Beds under water, Piers, Bays, Judicial decisions, Fluctuation, Water levels, Water level fluctuations, Tidal waters, Legal aspects.

In an action for injunction, plaintiff, owner of a certain riparian grant of land under the tide waters of the Delaware Bay, sought to stop defendant from erecting a pier which would extend from the defendant's property on the shore out into the bay and upon the submerged lands of plaintiff. Defendant contended that he was the owner of the submerged land which extended from his shore property. Defendant's contention was based upon the fact that he had been deeded property extending to the high water mark of the bay and that over time the high water line advanced upon his property. Defendant asserted that he yet owned to the original mark. The court held that when the high water mark of navigable waters is the boundary of property, such boundary is subject to change as the high water line changes. Defendant's ownership thus extended from the new high water mark and not from the original mark. Consequently plaintiff was the owner of the submerged land upon which the pier was to be constructed, and such ownership entitled plaintiff to have the construction of the pier enjoined. (Snow-Florida)
W70-10487

FREEMAN V CITY OF LAKEMILLS (LIABILITY FOR INJURY CAUSED BY NATURAL PROCESSES).
243 Wis 537, 11 NW2d 181-182 (1943).

Descriptors: *Wisconsin, *Natural flow, *Channel morphology, *Storm runoff, Storm drains, Surface waters, Sewers, Creeks, Seepage, Alteration of flow, Cities, Damages, Judicial decisions, Legal aspects, Obstruction to flow, Outlets, Tile drains, Ditches, Drainage practices, Relative rights, Riparian rights, Riparian land, Flooding, Overflow, Channel flow.

Plaintiff landowner brought action to abate an alleged nuisance and for damages for injury to his property. Plaintiff contended that seepage into his basement was caused by the overflow of a natural watercourse adjacent to his property into which flowed surface water from defendant city's storm sewers. Plaintiff contended further that such action by defendant caused refuse deposition in the creek and caused the bed of the creek to be raised, and that the channel change which resulted from the raising of the bed caused the overflow. Defendant admitted only that it had used the creek for an outlet for its storm water, and contended that the evidence did not support the trial court's judgment for plaintiff. The Supreme Court of Wisconsin held that a city has the same right with reference to surface waters as an individual would have. Cities are not liable to riparian owners for material and water that flows from their streets into surrounding streams. The change in the channel of the creek and the raising of the water was a natural process for which no legal liability could be placed on defendant. The judgment for plaintiff was reversed. (Price-Florida)
W70-10488

SIOUX CITY V BETZ (OWNERSHIP OF BEDS OF NAVIGABLE STREAM).
4 NW2d 872-873 (Iowa 1942).

Descriptors: *Iowa, *Land forming, *Patents, *Ownership of beds, Navigable waters, Missouri River, Accretion (Legal aspects), High water mark, Land tenure, Landfills, Channel morphology, Judicial decisions, Legal aspects, Cities, Real property, Beds under water.

Plaintiff city claimed title to certain lands through a patent from the state. The land was created by defendant's dumping of dirt into a navigable stream over a period of ten years. Defendant claimed the land through adverse possession. The court ruled that defendant had failed to prove the elements of adverse possession, and further that such defense was not available as against the state. The tract of land in question was situated below the high water mark of the river and as the state had title to the bed of the river from the high water mark to the center of the river, title to the land in question passed to plaintiff under the patent. Judgment for plaintiff was affirmed. (Clarke-Florida)
W70-10489

RUPP V KIRK (RIPARIAN OWNER'S TITLE TO ACCRETION).
4 NW2d 264-266 (Iowa 1942).

Descriptors: *Iowa, *Accretion (Legal aspects), *Channel morphology, *Alluvium, Navigable waters, Missouri River, Alluvial channels, Boundaries (Property), Boundary disputes, Sand bars, Chutes, Legal aspects, Judicial decisions, Vegetation, Vegetation growth, Channel erosion, Erosion.

In a riparian owner's suit to quiet title to land along the Missouri River, plaintiff alleged the land belonged to him as accretive land. Defendant claimed the land as an island and by adverse possession. The court rejected defendant's argument as to adverse possession and ruled that the evidence warranted a decree for plaintiff. The river had receded in 1927 and formed the bar in controversy, out from the shore of plaintiff's land, by gradual and imperceptible action of its waters. The land was therefore accretive land and plaintiff had title. Judgment for plaintiff was affirmed. (Price-Florida)
W70-10490

TODD V MURDOCK (RIPARIAN OWNERS' RIGHTS TO FRONTAGE ON NEW RIVER SHORE PROPORTIONATE TO ORIGINAL FRONTAGE).
300 NW 284-286 (Iowa 1941).

Descriptors: *Iowa, *Boundary disputes, *Accretion (Legal aspects), *Riparian land, Navigable waters, Missouri River, Erosion, Meanders, Shores, River flow, Riparian rights, Legal aspects, Judicial decisions, Boundaries (Property), Relative rights.

Plaintiffs sought to quiet title to certain land and to enjoin the construction of a fence thereon. Plaintiffs' lot and lots east thereof were originally bounded on the south by the Missouri River. Due to a southerly change in the course of the river, a considerable amount of land was formed between the lots and the new river bank. Plaintiffs claimed title by adverse possession and through a deed to the accreted lands south of their lots asserting that the boundary lines of the lots should merely be extended in their original direction to the bank. Defendant contended that new boundary lines should be drawn so as to save to save to all lot owners river frontage similar to that originally held. The court rejected plaintiffs' claim based on adverse possession. The court also found that the deed through which plaintiffs claimed was ineffective as to third parties. Landowners can agree as to the division of accreted lands except where rights of third parties would be infringed upon. The court held that defendant was entitled to frontage on the new shore proportionate to his frontage on the old shore. The trial court's decree for defendant was affirmed. (Price-Florida)
W70-10491

LUNDBERG V UNIVERSITY OF NOTRE DAME (APPLICABILITY OF NORTHWEST ORDINANCE TO NON-NAVIGABLE WATERS).
282 NW 70-77 (Wis 1938).

Descriptors: *Wisconsin, *Navigable waters, *Navigation, *Access routes, Legislation, Highways, Transportation, Lakes, Rivers, Navigable rivers, Real property, Judicial decisions, Legal

spects, Federal government, Mississippi River, Easements, Rightlof-way, Bodies of water.

Plaintiffs owned a summer resort on Tenderfoot Lake. Defendant University owned all the land surrounding nearby Plum Lake, 1400 feet northeast of Tenderfoot Lake, and all the land between the two lakes. Defendant erected a fence across a trail between the two lakes, and plaintiffs sought removal of the fence contending that: (1) the Northwest Ordinance of 1787 prohibited closing of a carrying place which is part of a public highway; and (2) plaintiffs had established an easement of passage between the lakes by prescription. The trial court found for plaintiffs on the first ground, not considering the second. The Supreme Court of Wisconsin reversed. The courts of Wisconsin are bound by the Northwest Ordinance. The ordinance provided for free and open access to navigable waters leading into the Mississippi or St. Lawrence Rivers and to carrying places or portage paths between such waters. The Ordinance applies only to waters found to be navigable and actually used for commerce at the time of the passage of the ordinance. However, the path here in question was not used for commerce in 1787, and defendant was entitled to erect a fence thereon. (Dye-Florida)
W70-10492

IN RE TRIBOROUGH BRIDGE APPROACH CONDEMNATION OF WATERFRONT PROPERTY).
159 Misc 617, 288 NYS 697-720 (1936).

Descriptors: *New York, *Condemnation, *Cities, *Eminent domain, Riparian rights, Public rights, Wharves, Docks, Legal aspects, Condemnation value, Right-of-way, Compensation, Judicial decisions, High water mark, Low water mark, Bridges, Real property, Beds, Ownership of beds, City planning, Local government, Administration, Navigation.

The City of New York sought to condemn property for construction of a bridge approach. Claimants to one lot contended that property to the low water mark was appurtenant to their upland property. Other claimants sought compensation for destruction of riparian rights appurtenant to a damaged lot at the location of a marginal street. (A marginal street is one used in connection with wharves and for the purpose of commerce. Such a street destroys riparian rights in appurtenant land. A marginal street is not public.) Claimants also sought compensation for a pier built by the city between high a low water mark adjacent to claimant's upland. The court stated that land between the low and high water mark belonged to the city unless specifically granted away. The court said claimants could have obtained title to the pier only if its construction was by a wrongdoer. The city in the instant case owned the property upon which the pier was constructed, thus it was not a wrongdoer. However, claimants were entitled to compensation for the taking of property on which the city had built a marginal street where claimants original grant excepted land to be used for public streets. (Dye-Florida)
W70-10493

ST REGIS PAPER CO V NEW HAMPSHIRE WATER RESOURCES BD (LOGGING SLUICEWAY FOR DAM).
26 A2d 832-842 (NH 1942).

Descriptors: *New Hampshire, *Dams, *Lumbering, *Pulp and paper industry, Access routes, Administrative agencies, State governments, Riparian rights, Navigation, Ownership of beds, Relative rights, Riparian land, Riparian waters, Navigable rivers, Dam construction, Sluices, Bypasses, Judicial decisions, Legal aspects, Public rights, Administrative decisions, Decision making.

Plaintiff paper company sued to require defendant water resources board to provide a means for passage of logs past a dam on a navigable river. Plaintiff claimed the right for passage of logs as a member of the public. However, use of the river for logging had been discontinued prior to construction of the dam. The court stated that public rivers were held in trust for the people, and also that when a stream is capable of public service in its natural state, it is public. Navigability was found to be only one test for useful public service. The court found that: (1) individual citizens were entitled to use public waters in a personal capacity only derivatively from their right as a member of the public, since their rights are unvested, non-property rights; (2) even riparian rights provide no right of action against state control of public water which does not damage private land; and (3) state regulation of the right to use public water included the power to bar use altogether. Reasoning that since logging was discontinued prior to dam construction, defendant had not arbitrarily failed to provide a sluiceway, and furthermore had no duty to provide one, the court gave judgment for defendant. (Hart-Florida)
W70-10494

CULLEY V HOLLIS (RIGHTS OF OWNERS OF LAND ABUTTING NAVIGABLE STREAMS TO ERECT IMPROVEMENTS IN SUCH STREAMS).
25 A2d 196-198 (Md 1942).

Descriptors: *Maryland, *Leases, *Competing uses, *Riparian rights, Relative rights, Navigable waters, Ownership of beds, Oysters, Conservation, Shores, Creeks, Permits, Federal government, State governments, Legislation, Riparian waters, Riparian land, Accretion (Legal aspects), Patents, Structures, Piers, Judicial decisions, Legal aspects, Usufructuary right.

Plaintiff sought to enjoin the construction of a pier by defendant. Plaintiff owned a lease giving him the right to grow and harvest oysters in the bed of a navigable stream. Defendant's land abutted the stream and the pier being constructed from defendant's land into the stream caused considerable damage to plaintiff's oyster bed. Plaintiff claimed his rights through a lease from the state and defendant relied on a state statute which gave proprietors of land bordering on navigable streams the exclusive right to make improvements into the water in front of their land. Piers had been previously determined by case law to be such an improvement as contemplated by the statute. Plaintiff contended he had a property right because of the lease which could not be taken without due process of law. The court ruled that when plaintiff acquired his lease he did so with notice of the above mentioned statute, and that owners of property abutting on the waters in which his lease was located had a right to make improvements from their land into the waters. The judgment for defendant was affirmed. (Price-Florida)
W70-10495

HOOD V CITY OF NASHUA (PRIVATE NUISANCE CAUSED BY IMPROPER MAINTENANCE OF CULVERT).
13 A2d 726-728 (NH 1940).

Descriptors: *New Hampshire, *Culverts, *Surface drainage, *Percolation, Surface runoff, Drainage practices, Damages, Relative rights, Drainage, Drainage effects, Drainage water, Drains, Cities, Legal aspects, Judicial decisions, Impounded waters, Impoundments, Structures, Percolating water, Seepage, Topsoil, Outlets, Subsoil.

Plaintiff landowner brought action for damages to his property which resulted from defendants' negligent maintenance of its drainage system. Water was allowed to collect in large quantities and flow through a culvert maintained by defendant onto land adjacent to plaintiff's land. From there the water would percolate into plaintiff's cellar. Defendant contended that there was a lack of the establishment of the necessary causal connection between the alleged improper maintenance and the injury suffered by plaintiff, that plaintiff had suffered no special damages that would give him the right to initiate such an action and that plaintiff had not given defendant notice of his intent to bring the action. The court ruled that the evidence supported the inference that the maintenance of the culvert caused the injury suffered by plaintiff, that plaintiff was the only one who suffered injury because of the culvert, that the negligent maintenance of the culvert was a private and not a public nuisance and that notice of intent to bring action was not required. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W70-10496

FIRST NAT'L BANK AND TRUST CO V ZONING BD OF APPEALS (OWNERSHIP OF BEDS OF NAVIGABLE WATERS).
126 Conn 228, 10 A2d 691-696 (1940).

Descriptors: *Connecticut, *Sea walls, *Navigation, *Ownership of beds, Navigable waters, High water mark, Low water mark, Riparian rights, Legislation, Grants, Permits, Right-of-way, Cities, Local governments, Administrative agencies, Administrative decisions, Legal aspects, Judicial decisions, Boundary disputes, Zoning, Public rights.

Plaintiff owned a mainland lot and an island across therefrom. To bring himself within zoning laws, plaintiff contended the two tracts were actually one lot. Plaintiff relied on grants by the state to his predecessors in title permitting the construction of seawalls between the high and low water mark in front of the tracts. Also granted was the right to fill in the space between the walls if such did not impede public navigation. Land thus created was to be the builders of the walls. Plaintiff contended the grants gave him in fee the land below the high water marks and therefore connected the two parcels. The court ruled the land did not belong to plaintiff as no sea walls had been constructed or fill created. The court found the waters between the tracts to be navigable at high tide, and to allow the interpretation contended for by plaintiff would infringe on public rights and rights of other riparian owners. (Price-Florida)
W70-10497

HARZ V BOARD OF COMMERCE AND NAVIGATION (TITLE TO SUBMERGED LAND).
126 NJ Eq 9, 7 A2d 803-808 (1939).

Descriptors: *New Jersey, *Submergence, *Boundary disputes, *Erosion, Waves (Water), Bank erosion, Accretion (Legal aspects), Low water mark, High water mark, Tides, Tidal effects, Tidal waters, Shores, Navigable waters, Leases, Grants, Condemnation, Land tenure, Legislation, Legal aspects, Judicial decisions, Administrative agencies, Overlying proprietor.

Defendant Board of Commerce and Navigation's lot abutted a bay and was located between the bay and plaintiff's lot. Originally the high water mark of the bay was on the lot now claimed by defendant. At the time defendant bought the lot it was submerged at high tide and the high water mark was on plaintiff's lot. Plaintiff sought a riparian lease with an option to buy the lands under the water of the bay in front of his lot. Defendant contended its lot was the upland bordering on the bay and it was entitled to the grant sought. The court stated that when what was once fast land is lost by erosion and is submerged at high tide, title thereto is in the state while it is submerged. A proprietor is subject to loss by erosion without remedy as he is subject to gain by accretion. The court held that plaintiff was the present riparian owner. Injunctive relief was withheld to give defendant a reasonable time to begin condemnation proceedings. (Price-Florida)
W70-10498

LEARY V CITY OF MANCHESTER (LIABILITY FOR NUISANCE CREATED BY FAILURE TO PROPERLY MAINTAIN DRAINAGE DITCH).
6 A2d 760-762 (NH 1939).

Descriptors: *New Hampshire, *Easements, *Ditches, *Drainage, Drainage effects, Drainage practices, Drainage water, Drains, Cities, Surface waters, Relative rights, Legal aspects, Judicial decisions, Water quality control, Water demand, Water levels, Municipal water.

Plaintiff landowner sought to abate an alleged nuisance caused by defendant city's construction and maintenance of a drainage ditch across plaintiff's land. Defendant had been granted an easement across the property for the purpose of draining off surface water which menaced the purity of its water supply. The ditch was to be maintained so as to cause no unreasonable or unnecessary damage to the premises. Defendant failed to maintain the ditch, and the court ruled that the condition which resulted constituted a nuisance from which plaintiff was entitled to relief. (Price-Florida)
W70-10499

ROONEY V MILLSTONE TP (DAMAGES FROM DISCHARGE OF SURFACE WATER DRAINAGE).
121 NJL 624, 3 A2d 580-581 (1939).

Descriptors: *New Jersey, *Drainage water, *Surface waters, *Flood damage, Drainage, Drainage systems, Surface runoff, Surface drainage, Drains, Runoff, Judicial decisions, Highways, Roads, Damages, Flooding, Ponding, Diversion, Routing, Alteration of flow, Diversion structures, Cities, Local governments, Jurisdiction.

In an action for damages, plaintiff contended that defendant municipality, while improving a road, built a catch basin upon plaintiff's property which from time to time overflowed causing damage to plaintiff's property. Defendant contended that it was immune from suit. The court held that a municipality has no right, by artificial drains, to divert surface water from its ordinary course and cast it, in a body large enough to do substantial injury, on land where, but for such artificial drains, it would not naturally go. The liability arising from such action is not to be dismissed due to a municipal corporation's exemption in that an active wrongdoing is involved to which the exemption does not apply. Defendant was thus held liable for the damages done to plaintiff's property as a result of the diversion of surface water. (Snow-Florida)
W70-10500

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, EAST FORK SAN JACINTO RIVER, REESE AND TARKINGTON BAYOUS, CLEVELAND, TEXAS.
Corps of Engineers, Galveston, Tex.
For primary bibliographic entry see Field 04A.
W70-10275

FLOOD PLAIN INFORMATION, PASCAGOULA - GAUTIER COASTAL AREA, JACKSON COUNTY, MISSISSIPPI.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
W70-10276

COMPREHENSIVE FLOOD PLAIN MANAGEMENT,
Office of the Chief of Engineers (Army), Washington, D.C.
For primary bibliographic entry see Field 06B.
W70-10355

6G. Ecologic Impact of Water Development

EFFECTS OF WATER IMPOUNDMENTS ON REPRODUCTION AND POPULATION NUMBER OF WATERFOWL ON THE SNAKE RIVER, WASHINGTON,
Washington State Univ., Pullman. Dept. of Wildlife Biology.
Irven O. Buss.
Available from NTIS as PB-194 456, $3.00 in paper copy, $0.65 in microfiche. Completion Report. 18 p, 4 tab, 2 fig. OWRR Project A-005-WASH (4).

Descriptors: *Geese (Wild), Ducks (Wild), *Ecology, *Waterfowl, Washington, Wildlife, *Canada Goose.
Identifiers: Snake River (Washington).

Data on nesting habits of the Canada Goose were collected in 1966, 1967, 1968, 1969, and 1970. During 1969 and 1970, significant differences from the 1954-65 data reported by Buss and Wing (1966) were noted. Sand or soil was preferred to rock for nest substrate. Twelve nest sites were reused one to four times between 1960 and 1967. One successful re-nesting attempt occurred with a 12-day re-nesting interval. Observations indicated that 50% or more of the gosling production on the Snake River came from cliff or riverbank nests. Broods remained within 1 mile of their island nests for several days and then moved slowly upstream or downstream. Many broods were reared in grassy pastures adjacent to the river. A rapid increase in geese in July and August, appearing shortly after the young gained greater mobility, suggested that geese had hatched in cliff and riverbank nests or had moved into the study area from elsewhere. Observations of marked geese and direct counts indicated that most locally reared geese as well as new arrivals left the study area in late August. Data on marked and banded birds indicated that at least a part of the local population wintered in east central Washington within 50 miles of the study area. Migrant geese began arriving on the Snake River in mid-September, and maximum numbers were observed in late November and December. About 25 percent of the geese observed in the winter were B.c. minima. None of the artificial islands or nesting structures were utilized for nesting during the first year after their construction.
W70-10117

AESTHETIC FACTORS IN PLANNING AND DESIGN OF LIBBY DAM,
Army Engineering District, Seattle, Wash.
Sydney Steinborn.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No PO1, p 39-54, Jan 1970. 16 p, 14 fig.

Descriptors: *Concrete dams, Dams, *Aesthetics, *Architecture, Gravity dams, *Environmental effects, *Environmental engineering, Environment , Landscaping, Structural design, Powerhouses, *Planning, Transmission lines, Project planning.
Identifiers: Visitor centers, *Libby Dam, Mont, Beautification.

The aesthetic and environmental planning and design of the Libby Dam Project in northwestern Montana are presented. Libby Dam is 3,000 ft long, 420 ft high, and contains 4,000,000 cu yd of concrete. The dam is in a beautiful mountain valley, and a major effort was and is being made in design and construction to minimize the impact of this massive structure on the environment. Development of a comprehensive landscape plan for the dam and immediate vicinity by a prominent consulting architect is described. Considerable attention was given to accommodation and movement of the visiting public. Details of these concepts and a design flow chart of the aesthetic and environmental planning process are presented. (USBR)
W70-10149

ENVIRONMENTAL POLLUTION-A SELECTIVE BIBLIOGRAPHY.
Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. Information Services Section.
For primary bibliographic entry see Field 10.
W70-10228

THE HYDROLOGY OF FOUR STREAMS IN WESTERN WASHINGTON AS RELATED TO SEVERAL PACIFIC SALMON SPECIES,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02E.
W70-10240

THE ECOLOGICAL BACKGROUND TO LAND-USE STUDIES IN TROPICAL AFRICA, WITH SPECIAL REFERENCE TO THE WEST,
Birmingham Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 02I.
W70-10309

POPULATION DENSITY AND AGRICULTURAL SYSTEMS IN WEST AFRICA,
Salford Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 03F.
W70-10310

MAN-WATER RELATIONS IN THE EAST CENTRAL SUDAN,
Birbeck Coll., London (England). Dept. of Geography.
Anne Graham.
In: Environment and Land Use in Africa, Chapter 15, p 409-445, Methuen, London, 1969. 9 fig, 1 tab, 6 ref.

Descriptors: *Economic impact, *Social function, *Social charge, *Semiarid climates, Agriculture, Grazing, Rainfall, Wells, Tropical regions, Water supply, Rural sociology, Human population, Livestock.
Identifiers: *Peasant agriculture, *Sudan, *Nomadism, *Immigration, Transhumance, Sedentarism, Hafirs, Local movement.

In contrast to large-scale irrigation projects rural water schemes have the advantage of spreading benefits over a large area with minimal costs and political problems. Ghedaref District in the central Sudan is a generally semiarid region with a seasonal rainfall whose mean value decreases from south to north. The population is made up of many races with diverse ways of life from several parts of Africa. Water supplies range from consistently abundant and reliable to seasonal and highly unreliable. Agriculture varies from grazing to sesame and dura sorghum crops with only a few areas growing cotton and vegetables. The ways of life are determined by water supplies and are of 4 main types: (1) nomadism, (2) transhumance, (3) local movements, and (4) sedentarism. The dominant clay plain has recently been exploited by governmental construction of excavation reservoirs (hafirs) which act as catchments during the rainy season, facilitating more extensive agriculture and year-round settlements. This has increased immigration and the increased population densities have in turn often acted to extend old problems rather than solve them. The resulting effects on the economics and sociology of the region are discussed. (Casey-Arizona)
W70-10311

FOLKLORE AND BROMIDES IN WATERSHED MANAGEMENT.
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 04D.
W70-10410

07. RESOURCES DATA

7A. Network Design

OPTIMUM OPERATING PROCEDURE FOR A RIVER GAGING STATION ESTABLISHED TO

PROVIDE DATA FOR DESIGN OF A WATER SUPPLY PROJECT,
Geological Survey, Washington, D.C.
Marshall E. Moss.
Water Resources Research, Vol 6, No 4, p 1051-1061, August 1970. 11 p, 9 fig, 14 ref.

Descriptors: *Data collections, *Optimization, *Cost-benefit analysis, *Hydrologic data, *Gaging stations, Water yield, Reservoir design, Streamflow forecasting, Economics, Statistics, California.
Identifiers: Sensitivity analysis, Data costs.

A scheme for determining the optimum length of streamflow record and the optimum frequency of discharge measurements was applied to the gaging station on Arroyo Seco, an intermittent stream near Soledad, California. If the streamflow record is used only in the design of a water supply reservoir at the gage site, the optimum record length is found to vary between 9 and 56 years, depending on nonhydrologic time constraints. The optimum frequency of measurement of discharge for calibration of the station rating curve is found to be indeterminate. Sensitivity analysis indicates that the optimum length of record is more sensitive to the variability of the streamflow and the planned level of development at the site than to discount rate or cost of obtaining streamflow data. (Knapp-USGS)
W70-10057

ESTIMATING COEFFICIENTS OF A FLOW GENERATOR FOR MONOTONE SAMPLES OF DATA,
American Univ., Washington, D.C.; and Geological Survey,
David S. Crosby, and Thomas Maddock, III.
Water Resources Research, Vol 6, No 4, p 1079-1086, August 1970. 8 p, 13 tab, 8 ref, append.

Descriptors: *Synthetic hydrology, *Data collections, *Time series analysis, Correlation analysis, Streamflow forecasting, Statistical methods, Statistics, Regression analysis, Hydrologic data, Gaging stations.
Identifiers: Monotone samples.

If a set of flow records continuous in collection to the present has different starting times, it forms a monotone sample. The monotone sample may yield an inconsistent lag zero convariance matrix. In addition, it may be impossible to calculate real-value coefficients for a flow generator, leading to some complex values for the synthetic flow trace. A technique is presented that produces a consistent lag zero covariance matrix and a realvalue multisite streamflow generator. (Knapp-USGS)
W70-10068

TRITIUM AND HYDROGEOLOGY-INVESTIGATIONS AND MEASUREMENTS CARRIED OUT AT THE GRENOBLE NUCLEAR RESEARCH CENTER (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleares.
J. Guizerix, R. Margrita, M. Launay, and P. Ruby.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/31, p 433-450, 1967. 18 p, 17 fig, 6 ref.

Descriptors: *Tritium, *Fallout, Groundwater movement, *Karst, *Aquifers, Hydrogeology, Tracers, Tracking techniques, Sampling, Hydrologic data, Monitoring.
Identifiers: France.

Tritiated water of thermonuclear origin is a new and very interesting parameter of which the hydrogeologist is making increasing use in the study of various problems. In karsts, the water from precipitation shows an annual maximum of concentrations in June. This signal can be used to establish correlations between the losses from an aquifer and resurgence about 30 km away, by means of a series of systematic measurements of the precipitation supplying aquifers and springs. These measurements have been valuable in a trial project involving a gamma-emitting tracer. A network for the collection of atmospheric tritiated water was set up for the collection and measurement of monthly samples collected at 26 stations spread fairly evenly across France. Its purpose is twofold: Primarily to constitute a bank of samples, or sampling data, for use in any subsequent hydrological studies carried out in France; and secondly, to permit study of the spatial distribution of tritium fallout. Tritium isoconcentration curves show a sea/continent effect, whereby tritium concentraions increase inland. (Knapp-USGS)
W70-10097

ULTRASONIC FLOWMETER,
Public Works Research Inst., Tokyo (Japan).
For primary bibliographic entry see Field 04A.
W70-10139

7B. Data Acquisition

REMOTE SENSING OF OIL SLICKS,
Federal Water Pollution Control Administration, Washington, D.C. Div. of Water Quality Research.
For primary bibliographic entry see Field 05A.
W70-10045

IMPROVEMENTS IN THE VAN BAVEL-MYERS AUTOMATIC WEIGHING LYSIMETER,
Nebraska Univ., Lincoln.
Norman J. Rosenberg, and K. W. Brown.
Water Resources Research, Vol 6, No 4, p 1227-1229, August 1970. 3 p, 1 fig, 9 ref. OWRR Project A-001-NEB.

Descriptors: *Lysimeters, *Automation, *Instrumentation, Design, Equipment, *Evapotranspiration, Nebraska.
Identifiers: Automatic weighing lysimeters.

The performance of the Van Bavel-Myers lysimeter was improved in two units installed at Mead, Nebraska. The units function according to design specifications (0.01 mm precision; 0.05 mm accuracy) after the following modifications were made: (1) provide drainage to maintain underground portions of the lysimeter in a water free condition, (2) relocate the electrical junctions to assure high electrical resistance between ground and the strain gage load cell, and (3) make mechanical damping devices accessible for cleaning and adjustment. (Knapp-USGS)
W70-10062

THE MEASUREMENT OF GRADATION USING SURVEYED CROSS SECTIONS,
Forest and Range Experiment Station, Rangiora (New Zealand).
For primary bibliographic entry see Field 02E.
W70-10063

A CRITIQUE OF METHODS SIMULATING RAINFALL,
Imperial Coll. of Science and Technology, London (England).
For primary bibliographic entry see Field 02B.
W70-10065

AUTOMATION OF ATOMIC ABSORPTION ANALYSES,
Geological Survey, Denver, Colo.
M. J. Fishman, and D. E. Erdmann.
French and German abstracts. Atomic Absorption Newsletter, Vol 9, No 4, p 88-89, July-August, 1970. 2 p, 1 fig, 3 tab, 1 ref.

Descriptors: *Chemical analysis, *Spectrophotometry, *Colorimetry, *Automation, *Analytical techniques, Laboratory equipment, Water analysis, Laboratory tests, Trace elements, Water quality, Water chemistry.
Identifiers: *Atomic absorption analysis, *Direct aspiration, Data printout.

An atomic absorption spectrophotometer is automated with a sampler, proportioning pump manifold, and strip-chart recorder. Copper, lithium, manganese, potassium, sodium, iron, and zinc are determined by direct aspiration from the sampler. The proportioning pump manifold is added to the system for the determination of calcium, magnesium, and strontium. It introduces, automatically, an interference suppressant to the samples prior to aspiration. The latter system can also be used to make dilutions. (Woodard-USGS)
W70-10089

STREAM GAUGING TECHNIQUES FOR REMOTE AREAS USING PORTABLE EQUIPMENT,
British Columbia Univ., Vancouver. Dept. of Geography; and Research Council of Alberta, Edmonton.
Michael Church, and Rolf Kellerhals.
Canada Inland Waters Branch Technical Bulletin No 25, Department of Energy, Mines and Resources, 1970. 89 p, 24 fig, 11 tab, 109 ref.

Descriptors: *Stream gages, *Discharge measurement, *Instrumentation, Flowmeters, Current meters, Gaging stations, Stage-discharge relations, Dye releases, Tracers, Tracking techniques, Streamflow, Discharge (Water), Water measurement.
Identifiers: *Portable stream gaging equipment.

A variety of streamflow measuring techniques applicable to rivers with peak flows up to 10,000 cfs are reviewed. The methods are primarily suitable for the economical collection of short-term records at inaccessible or isolated sites. The emphasis is on field practice, with considerable detail being presented for the major techniques. The methods discussed include estimates of runoff using basin survey data, stage-discharge relations, artificial controls, current meters, dilution methods, and tracers. (Knapp-USGS)
W70-10090

INVESTIGATION OF GROUNDWATER FLOW WITH RADIOCARBON,
Groningen Rijksuniversiteit (Netherlands).
For primary bibliographic entry see Field 02F.
W70-10092

THE APPLICATION OF RADIATION LOGS TO GROUNDWATER HYDROLOGY,
Geological Survey, Denver, Colo.
W. Scott Keys.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/33, p 477-488, 1967. 12 p, 4 fig, 6 ref.

Descriptors: *Borehole geophysics, *Radioactivity techniques, Hydrogeology, Aquifers, Radioactivity, Tracers, Logging (Recording), Subsurface investigations, Groundwater movement, Nuclear moisture meters, Boreholes.
Identifiers: Radiation well-logs, Test wells.

The only technique available at present for obtaining geological and hydrological information through the casing of pre-existing water wells and other boreholes is by radiation logging. Inexpensive portable radiation logging equipment is available or has been developed for groundwater studies in connection with a general research project on the application of borehole geophysics in groundwater hydrology. It is possible to obtain data on the following: the source, velocity, and chemical quality of groundwater; the location, extent, geometry, bulk density, porosity, permeability, and specific

yield of aquifers and associated strata; and the position of casings, casing collars, leaks, perforations, and cement. The radiation logs employed include natural gamma, gamma-gamma, neutron-gamma, neutron epithermal-neutron, and radioactive tracer. Typical radiation logs obtained by the various techniques are described and examples are given of practical application of radiation logging to groundwater investigations. The applications cited are studies of perched water in basaltic rocks and associated sedimentary strata; the porosity, moisture content, and position of zones into which water was injected in volcanic tuff; the position of the interface between brine and fresh water in fine-grained carbonate rocks and associated fine clastic rocks; the interpretation of porosity from a neutron log, and the location by means of a radioactive tracer of the more permeable fracture zones in a well penetrating crystalline rock. (Knapp-USGS)
W70-10099

RADIOISOTOPE TRACERS IN LARGE-SCALE RECHARGE STUDIES OF GROUNDWATER,
Water Planning for Israel Ltd., Tel Aviv (Israel); and Weizmann Inst. of Science, Rehovoth (Israel).
R. Sternau, J. Schwarz, A. Mercado, Y. Harpaz, and A. Nir.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/34, p 489-505, 1967. 17 p, 9 fig, 24 ref.

Descriptors: *Tracers, *Groundwater movement, *Radioactivity techniques, *Tagging, Cobalt, Cobalt radioisotopes, Sampling, Pumping, Boreholes, Aquifers, Recharge, Monitoring, Radioisotopes.
Identifiers: Israel.

Dynamic investigations of large-scale groundwater recharge and mixing require a reliable tracing method. In the absence of natural tracer in the recharged water, tagging with Co-60 afforded excellent tracing possibilities. The hydrological basis, isotope production, injection, pumping, sampling procedures, and evaluation of results are described. For measurements of the pumped water in the field, a special gamma-detection system was designed. Small samples from observation boreholes were taken to the laboratory for measurements in another specially-designed system. Routine large-scale hydrological engineering applications of radio tracers are beneficial and feasible. Owing to the sensitivity and stability of the monitoring system, the concentration of tracer at input was low enough to ensure public protection without any sacrifice of precision. (Knapp-USGS)
W70-10100

SINGLE-WELL PULSE TECHNIQUE,
Geological Inst., Warsaw (Poland); Federal Experimental and Research Inst., Vienna (Austria); and Institute of Nuclear Research, Krakow (Poland).
M. Borowczyk, J. Mairhofer, and A. Zuber.
Supported by International Atomic Energy Agency. In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/35, p 507-519, 1967. 13 p, 6 fig, 1 tab, 8 ref.

Descriptors: *Tracers, *Tracing techniques, *Groundwater movement, *Aquifers, Groundwater basins, Sampling, Monitoring, Tagging, Radioisotopes, Boreholes.
Identifiers: Vienna Basin (Austria).

Some theoretical and experimental problems of the single-well pulse technique proposed in Israel are discussed. The single-well technique is based on a traced injection, pause and pumping. Knowing the thickness of an aquifer as well as the pumping rate, it is possible to find a distance travelled by a tracer during the pause from the measurement of tracer concentration in pumped water. The ratio of distance and duration of the pause gives natural groundwater velocity. The problem may sometimes be solved for a two-layered aquifer. A new method for interpreting the arrival time of the tracer is proposed. It is based on the time of 50% recovery of recovered amount of an injected tracer. Many limitations of the technique and an example of complex interpretation are discussed in detail. Final results are compared with those obtained from classical and other tracer methods. A general interpretation of all the data suggests that most of the water in the investigated part of the Vienna Basin flows very quickly through highly permeable zones and that the movement of water probably takes place mainly in the upper layers of the aquifer. (Knapp-USGS)
W70-10101

INVESTIGATIONS INTO GROUNDWATER BALANCE BY APPLYING RADIOISOTOPE TRACERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
K. Ubell.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/36, p 521-530, 1967. 10 p, 5 fig, 5 ref.

Descriptors: *Tracers, *Tracking techniques, *Groundwater movement, *Soil water movement, *Water balance, Recharge, Sampling, Radioactivity techniques, Velocity, Mixing, Dispersion, Water resources development.
Identifiers: Hungary.

The methods used and the results obtained in Hungary in connection with field tests supplying radioactive tracers for solving the problems of natural groundwater balance are discussed. Moisture movements taking place through the aeration zone, recharge due to precipitation, and evaporation loss of groundwater are determined by systematic soil-moisture measurements carried out in whole vertical profiles, from the land surface down to the water table, with the aid of neutron-diffusion, based on the application of radioactive isotopes of Pu-Be source-detector as neutron radiation emitter. The flow of groundwater and horizontal movement in the zone of aeration as well as the velocity distribution according to depth are studied by multiwell tracing and single-well techniques by using I-131 tracers. (Knapp-USGS)
W70-10102

BOREHOLE DILUTION TECHNIQUES: A CRITICAL REVIEW,
International Atomic Energy Agency, Vienna (Austria); Federal Experimental and Research Inst., Vienna (Austria); and Institute of Nuclear Research, Kracow (Poland).
E. Halevy, H. Moser, O. Zellhofer, and A. Zuber.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/37, p 531-564, 1967. 34 p, 19 fig, 1 tab, 50 ref.

Descriptors: *Tracers, *Radioactivity techniques, *Groundwater movement, *Borehole geophysics, *Reviews, Bibliographies, Sampling, Monitoring, Aquifers, Mixing, Dispersion, Nuclear meters, Hydrogeology.
Identifiers: *Dilution techniques (Tracers).

Borehole dilution techniques for the determinations of filtration velocity, vertical flows and direction of groundwater flow are reviewed. The principles underlying each measurement, instrumentation, disturbing influences, and their possible correction are discussed and recommendations are made for applications and future research. (Knapp-USGS)
W70-10103

RADIOMETRIC METHOD OF SEEPAGE CONTROL IN DAMS AND THEIR ENVIRONS (RUSSIAN),
Polish Academy of Science, Gdansk. Inst. of Hydraulic Research.
J. Makowski.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/40, p 601-616, 1967. 16 p, 13 fig, 1 tab, 7 ref.

Descriptors: *Radioactivity techniques, *Tracers, *Seepage, *Reservoir leakage, Infiltration, Soils, Sands, Clays, Aquifers, Instrumentation, Sampling, Radioisotopes.
Identifiers: Poland.

For tracer studies of seepage, methods of choosing the injection point, techniques for introducing the radioactive solution into the soil, and the conditions that must be considered when selecting the radioisotope are described. The methods of measurement used are discussed, and a brief description of the equipment is given. A small probe was designed to measure the volumetric weight of the soil to determine the best injection point where the soil is most permeable. The radioisotopes used in the the investigations described are Cr-51 in the form Na2Cr04, Br-82 in the forms KBr and NH Br, I-131 in the forms NaI and KI, Sb-124 in the form SbC13 and Au-198 in the form HAuC14. Their adsorption values are given for pure sand soils, sand and clay mixtures and rocky soils (granite). (Knapp-USGS)
W70-10105

LABORATORY EVALUATION OF Cr-51 EDTA AS A TRACER FOR GROUNDWATER FLOW,
Chalmers Univ. of Technology, Goteborg (Sweden); and Ingeniors Vetenskaps Akademien, Stockholm (Sweden).
G. Knutsson, and H. G. Forsberg.
In: Isotopes in Hydrology, Proceedings Symposium of International Atomic Energy Agency and International Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-83/42, p 629-652, 1967. 14 p, 10 fig, 2 tab, 15 ref.

Descriptors: *Tracers, *Groundwater movement, *Chromium, *Radioisotopes, *Chelation, Adsorption, Water chemistry, Tracking techniques, Tritium, Laboratory tests, Sampling, Monitoring, Calibrations.
Identifiers: EDTA complexes.

The Cr-51 EDTA complex can be used successfully for tracing groundwater movement. In many cases spiking of the Cr-51 tracer with tritium is advantageous, and a procedure has been worked out for their simultaneous determination by liquid-scintillation counting. This technique has proved to be particularly useful when the samples are not too dilute. The use of a flow cell for continuous recording during column tests was studied, and the possibility of applying this method to field investigations is discussed. Cr-51 EDTA, at concentrations down to 0.001 ppm, is neither adsorbed nor much retarded in minerals such as quartz, feldspars, some micas, calcite and dolomite. Some of the ferromagnesian silicates and other iron-bearing minerals have a considerable effect. Upon passage through secondary minerals, such as clay minerals, Cr-51 EDTA is retarded, and chlorite particularly causes a marked delay. Losses of the complex seem to occur in illite. Tritium is retarded more than Cr-51 EDTA in bentonite and in montmorillonite, and to some extent in the other clay minerals. Variation in pH or in flow-rate does not affect the behavior of Cr-51 EDTA. Some recent field experience of the use of Cr-51 EDTA in Sweden and elsewhere is discussed briefly. (Knapp-USGS)
W70-10106

APPLICATION OF THE INTEGRATION METHOD TO THE DETECTION OF WATER-

3ORNE Cr-51-EDTA AND RADON ON AC-TIVATED CARBON (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleares.
. Molinari, and J. Guizerix.
n: Isotopes in Hydrology, Proceedings Symposium f International Atomic Energy Agency and Inter-ational Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-3/43, p 653-668, 1967. 16 p, 14 fig, 9 ref.

Descriptors: *Tracers, *Groundwater movement, Chromium, *Radioisotopes, *Chelation, Adsorp-on, Water chemistry, Tracking techniques, Calibrations, Activated carbon.
Identifiers: Radon.

The choice of a tracer for groundwater hydrology epends on the behavior of the tracer in relation to ne ground it passes through and on the sensitivity ith which it can be detected. Cr-51, which is ecognized as a good radioactive tracer for ground-ater is suggested, in a method in which en-chment is achieved by dripping labeled water nto activated carbon. At very low concentrations ne radioactivity of the tracer was partly masked by ne natural water radioactivity fixed in the carbon. The artificial tracer can be distinguished by dif-erential gamma spectrometry. (Knapp-USGS)
W70-10107

CAPABILITIES AND POTENTIAL OF USAEC'S CURRENT METER FOR ULTRA-LOS-VELOCITY MEASUREMENTS,
Tennessee Valley Authority, Norris.
. A. Elder, and S. Vigander.
n: Isotopes in Hydrology, Proceedings Symposium f International Atomic Energy Agency and Inter-ational Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-3/47, p 683-695, 1967. 13 p, 9 fig, 1 tab, 3 ref.

Descriptors: *Current meters, *Radioisotopes, Tracers, *Streamflow, Tennessee Valley Authori-y, Project, Sampling, Monitoring, Flow, Reser-oirs, Currents (Water), Limnology, Tracking echniques.
Identifiers: Low velocity current meter.

A low-velocity current meter operates on the time-f-travel principle using I-131 as the tracer. It was sed during 1966 on a comprehensive study of the hermohydrodynamics of TVA's Fontana Reser-oir. Inflow and outflow conditions in a highly tratified reservoir were studied in considerable etail. Velocities from 0.005 to 0.2 ft/s were resent in the flow zones in both the upstream and ownstream directions. (Knapp-USGS)
W70-10108

FUNDAMENTALS OF THE DISPERSION OF RADIONUCLIDES IN SANDY AQUIFERS,
Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).
For primary bibliographic entry see Field 02F.
W70-10109

LOCALIZATION OF LEAKAGES FROM A LARGE RESERVOIR, USING RADIOACTIVE TRACERS (FRENCH),
Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleares.
. Guizerix, J. Molinari, B. Gaillard, H. Santos Cottin, and A. Mornas.
n: Isotopes in Hydrology, Proceedings Symposium f International Atomic Energy Agency and Inter-ational Union Geodesy and Geophysics, Vienna, Nov 14-18, 1966: International Atomic Energy Agency STI/PUB/141, Vienna, Paper No SM-3/39, p 587-599, 1967. 13 p, 10 fig, 13 ref.

Descriptors: *Tracers, *Reservoir leakage, Tracking techniques, *Radioactivity techniques, Radioisotopes, Tagging, Seepage, Infiltration, Dams, Reservoirs.
Identifiers: Reservoir leak tracing.

Radioactive tracers were used to establish the source of losses from an earth dam. The zones of infiltration were determined by injecting radioactive tracers in the lake at points and along lines over distances of about 50 m. The radioactivity of the water was then checked at the outlet from the dam's drains, and curves were prepared showing the point at which the radioactive cloud reached the bottom of the water in the reservoir; this was done by using a nuclear probe lowered over the side of a boat whose position was plotted from the bank. The envelope of the curves obtained when activity is detected at the outlet of the drains defines the infiltration area of the lost water. A detailed explanation is given of the technique and the modifications which might be necessary to suit special situations which can arise; these consist of using tracers easily adsorbed onto the bottom of the stored water, the use of labeled sediments and the injection of tracers through pierced tubes placed at the bottom of the reservoir. (Knapp-USGS)
W70-10110

THE FLOW OF A STREAM THROUGH A RESERVOIR,
Gemeinnutziges Institut, Duesseldorf (West Germany).
For primary bibliographic entry see Field 02E.
W70-10111

REMOTE SENSING OF EARTH RESOURCES, A LITERATURE SURVEY WITH INDEXES.
National Aeronautics and Space Administration, Washington, D.C.

Available from NTIS as NASA SP-7036, $10.00 in paper copy. Special Publication NASA SP-7036, September 1970. 1221 p, 3684 ref.

Descriptors: *Bibliographies, *Remote sensors, Agriculture, Forestry, Environmental effects, Geodesy, Cartography, Geology, Mineralogy, Oceanography, Marine Geology, Hydrology, Data processing, Instrumentation, Geophysics, Satellites (Artificial).
Identifiers: *Earth resources, Cultural resources.

This literature survey lists 3684 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1962 and February 1970. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, oceanography and marine resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.
W70-10126

MINIMIZING ERRORS IN GAMMA-RAY SURFACE-TYPE DENSITY GAGES: EXISTING GAGES AND NEW DESIGN CONCEPTS,
North Carolina State Univ., Raleigh.
For primary bibliographic entry see Field 08G.
W70-10143

METHODS OF DETERMINATION OF WATER IN MATERIALS OF DIFFERENT STATE OF AGGREGATION (IN RUSSIAN),
Chemico-Technological Inst., Moscow (USSR).
For primary bibliographic entry see Field 02G.
W70-10168

IMPROVING TREE TRANSPIRATION ESTIMATES BASED ON HEAT PULSE VELOCITY MEASUREMENTS,
Forest Service (USDA), Fort Collins, Colo. Rocky Mountain Forest and Range Experiment Station.
For primary bibliographic entry see Field 02D.
W70-10286

ASSAYING ALGAL GROWTH WITH RESPECT TO NITRATE CONCENTRATION BY A CONTINUOUS FLOW TURBIDOSTAT,
California Univ., Berkeley; and Ministry of Health, Jerusalem (Israel).
For primary bibliographic entry see Field 05A.
W70-10403

INTERPRETING NEUTRON PROBE READINGS IN FROZEN SOIL.
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard A. Sartz.
USDA Forest Service Res Note NC-77, 1969. 4 p.

Descriptors: *Soil water movement, *Gravitational water, *Hydrologic properties, *Infiltration, Moisture content, Percolating water, Permeability, Soil physics, Wisconsin, Nuclear meters.
Identifiers: Interflow.

Several factors associated with soil freezing complicate the inperpretation of neutron probe readings in frozen soil. Temperature is unimportant, but the effect of vertical resolution must be considered. Because of the possibility of both gains and losses of water at the same depth during a period of measurement, interpreting changes in the water content of frozen soil is a subjective process. (Sartz-Forest Service)
W70-10412

A DEVICE FOR MEASURING SOIL FROST,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station.
James H. Patric, and Burley D. Fridley.
USDA Forest Service Research Note NE-94, 1969. 7 p, illus.

Descriptors: *Frost, *Frozen ground, *Frozen soils, Freezing, Heat transfer, Soil temperature, West Virginia.

A water-filled plastic tube buried vertically in the soil in a copper casing permitted repeated observation of frost depth without damaging the sampling site. The device is simple and inexpensive and provides data on soil freezing at least as accurate as direct observation by digging through frozen soil. (Patric-Forest Service)
W70-10415

7C. Evaluation, Processing and Publication

LEAST SQUARES ESTIMATION OF CONSTANTS IN A LINEAR RECESSION MODEL,
Kentucky Univ., Lexington.
For primary bibliographic entry see Field 06A.
W70-10052

A NUMERICAL SOLUTION FOR FINITE AMPLITUDE FREE SURFACE WAVES,
Arizona Univ., Tucson.
D. D. Fangmeier.
Water Resources Research, Vol 6, No 4, p 1216-1219, August 1970. 4 p, 3 fig, 10 ref.

Descriptors: *Computer programs, *Waves (Water), *Open channel flow, Linear programming, Streamflow, Velocity, Hydraulic models, Digital computers.
Identifiers: Wave tanks.

A technique for the numerical solution of two-dimensional potential flow with a free surface and gravity is presented. Its validity is demonstrated by application to wave generation by a pressure on a segment of the free surface of a ponded fluid. Wave profiles are obtained for the leading waves of progressive approximately periodic wave formations that show the effect of retaining the nonlinear

terms in the free surface boundary conditions. The programming is relatively simple and the technique applicable to other wave forming situations. However, long computation times are required. (Knapp-USGS)
W70-10060

RUNOFF GENERATION IN WESTERN WASHINGTON AS A FUNCTION OF PRECIPITATION AND WATERSHED CHARACTERISTICS,
Washington State Univ., Pullman. Coll. of Engineering Research Div.
For primary bibliographic entry see Field 02A.
W70-10122

A DIGITAL MODEL FOR AQUIFER EVALUATION,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02F.
W70-10238

SELECTION OF FREQUENCY DISTRIBUTION MODELS,
Nevada Univ., Reno.
For primary bibliographic entry see Field 02A.
W70-10246

QUASILINEARIZATION AND NONLINEAR PROBLEMS IN FLUID AND ORBITAL MECHANICS,
North American Rockwell Corp., Downey, Calif.
For primary bibliographic entry see Field 08B.
W70-10272

SPECTRAL ANALYSIS--APPLICATIONS IN WATER POLLUTION CONTROL,
Federal Water Pollution Control Administration, Washington, D.C. Estuarine and Oceanographic Programs Branch.
For primary bibliographic entry see Field 05A.
W70-10279

08. ENGINEERING WORKS

8A. Structures

DESIGN OF BOUNDARY ARCH DAM,
Bechtel Corp, San Francisco, Calif.
Jaroslav Pospisil, and Michael D. Hayes.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No PO1, p 73-91, Jan 1970. 19 p, 12 fig, 3 tab, 5 ref, append.

Descriptors: *Arch dams, Dam construction, *Dam design, *Concrete dams, Stress analysis, *Structural analysis, Dams, Electric analogs, Grouting, Simulation analysis, Analog models, Contraction joints, Instrumentation, Spillway gates, Sluice gates, Uplift pressure, Dam foundations, Cooling, Diversion, Engineering geology, Foundation investigations, Abutments.
Identifiers: *Thin arch dams, *Double-curvature arch dams, *Boundary Dam, Wash, Overtopping.

Preliminary design of the 360-ft-high, double-curvature, thin-arch dam was based principally on the crown cantilever adjustment method. Final design was based on the electric analogy simulation method whereby instead of constructing an analogy model, equations were written to simulate the analog and solved analytically by computer. The dam is equipped with 7 large sluice gates located 200 ft below the crest, 2 spillway gates, and ice and trash skimmer gate, and a horizontally moving maintenance gate to serve all sluice openings under full reservoir head. Arrangement and grouting of contraction joints, concrete cooling, instrumentation, site investigation and geology, hydrology, and abutment stability analysis are described. The design allowed for overtopping the partially completed dam during the flood season. (USBR)
W70-10142

PERMAFROST PRESENTS MECHANICAL CHALLENGES,
Kroeker (J. Donald) and Associates, Portland, Oreg.
J. Donald Kroeker.
Building System Design, Vol 67, No 5, p 17-22, May 1970. 6 p, 10 fig, 4 ref.

Descriptors: *Permafrost, Freezing, Foundation investigations, *Frozen ground, Cold regions, *Foundations, Thawing, *Frozen soils, Ventilation, Cold weather construction, Frost action, Frost heaving, Structures, Pile foundations, Refrigeration, Supports, Refrigerants, Insulation, *Piping systems (Mechanical), Slabs, *Buildings.
Identifiers: Cold climates, Building design, Ice lenses, *Cooling systems.

Prevention of thawing of permafrost upon which buildings and structures for conveying piping rest is a major problem in the frozen north. Permafrost is the permanently frozen ground below the active layer of ground subject to freezing and thawing. A type of foundation that has become traditional and is still used in many buildings through 4 stories in height consists of pilings extending into stable permafrost with first floors at least 4 ft above ground to prevent thawing beyond the active layer by heat transmission from the building. This type of support requires drilling holes into the permafrost, setting piling, backfilling with slurry, then waiting for freeze-back that may take several months. Piping systems for water supply, heating, and sewage disposal are run in utilidors also above grade. In the case of slab-on-grade foundations or in extremely high load conditions, a means of freezing the active frost zone is provided. For foundations set directly on permafrost, a means is provided to maintain the permafrost in a frozen condition. Several artificial freezing systems for foundations are discussed. Typical designs from Army Technical Manual TM5-582 for protection of permafrost under structures having floor levels above and on grade are presented. (USBR)
W70-10144

ARCH DAM DESIGN: STATE OF THE ART,
Bureau of Reclamation, Denver, Colo.
Merlin D. Copen, and Loyd R. Scrivner.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No PO1, p 93-108, Jan 1970. 16 p, 9 fig, 1 tab, 4 ref, append.

Descriptors: *Arch dams, Concrete dams, Dams, *Dam design, Deflection, Shape, Structural analysis, Structural behavior, Design criteria, Loads (Forces), Trial-load method, Safety factors, Stress analysis, Damsites, Tensile stress, Thrust, Dam foundations, Spillways, Foundation investigations, Rock mechanics.
Identifiers: Thin arch dams, Double-curvature arch dams, *Design practices, *Design improvements, Computer-aided design.

Prominent trends in arch dams include using thinner, more complex shapes that take advantage of inherent structural qualities of arch dams and adapt to more difficult site conditions. Large- and small-scale structural qualities of arch dams and adapt to more difficult site conditions. Large- and small-scale structural models are used for arch dam analysis; development of electronic computers has made the use of several complex and comprehensive methods of analysis feasible, including the trial-load, shell-theory, finite element, and dynamic-relation methods. The methods permit rapid, reliable evaluation of many alternative solutions for each site, subjected to all anticipated loading conditions. Good comparisons between computed and measured prototype behavior have substantiated design analyses. Better understanding of foundation requirements and rock mechanics has contributed greater safety and efficiency to arch dam design. Computed safety factors of 4 to 1 are usually required for arch dams for normal loading condtions, with a reduction permitted for unusual loading. If design features permit their consideration, orifice or overflow free-fall spillways may be more economical than tunnel or side channel spillways usually designed for arch dams. (USBR)
W70-10146

SELECT RESERVOIR WITHDRAWAL BY MULTILEVEL INTAKES,
Army Engineer District, Savannah, Ga.
Walter B. Benton, William J. Wall, and Shelton R. McKEEVER.
Proceedings, American Society of Civil Engineers, Journal of the Power Division, Vol 96, No PO1, p 109-115, Jan 1970. 7 p, 3 fig, 1 tab.

Descriptors: *Reservoir operation, Reservoir storage, Reservoirs, *Withdrawal, *Intakes, *Outlets, Stratification, Water quality, Outlet works, Hydraulic models, Intake structures, Thermocline, Saline water, North Carolina, *Water quality control.
Identifiers: *Selective level releases, *Multilevel outlets, New Hope Reservoir, N C/ Army Engineer Waterways Expt Sta.

Hydraulic model tests verify that multilevel intakes are an effective design for selective reservoir withdrawal. New Hope Dam and Reservoir, Cape Fear River Basin, N C, uses a multilevel intake design for selective withdrawal of impounded water as an aid in water quality control. The intakes permit flexibility in selecting the stratum from which reservoir releases are made. The model test results indicated that the proposed structure will provide effective regulation for control of water quality during the summer (minimum and average flows of 300 cfs and 800 cfs). Flows of 2400 cfs can be released without withdrawing flow below the thermocline, provided both sides of the intake structure are used and the thermocline is 40 ft below the upper pool elevation. The model indicated that operational releases of 2700 cfs through only one side of the structure will withdraw quantities as great as 10% to 33% from below the thermocline located from 40 to 90 ft, respectively, below the surface of the upper pool. The lower side intakes are least effective in drawing from the upper stratum. This may be improved by locating the structure farther away from the earth dam embankment. Model studies revealed that vibration of intake tower would not be a problem. (USBR)
W70-10147

EFFECTS OF RESERVOIR IMPOUNDMENT ON WATER QUALITY,
Army Engineer District, Savannah, Ga.
For primary bibliographic entry see Field 05G.
W70-10148

AESTHETIC FACTORS IN PLANNING AND DESIGN OF LIBBY DAM,
Army Engineering District, Seattle, Wash.
For primary bibliographic entry see Field 06G.
W70-10149

ECONOMIC LOCATION OF LOCKS,
Eric E. Bottoms.
Bulletin of the Permanent International Association of Navigation Congresses, Vol 3/4, No 2, p 45-55, 1968-1969. 20 fig, 19 ref.

Descriptors: *Locks, River basin development, Channel improvement, Inland waterways, Channels.
Identifiers: *Lock location, *Lock design, Mississippi River, Ohio River, Monongahela River, Tennessee River, Gallipolis Dam and Locks, Welland Canal.

The size and location of navigation locks are determined by many factors: economic, geologic, the nature of traffic, ease and safety of navigation. The latter two are often neglected in order to curtail costs, with the result sometimes being difficult and hazardous navigation, and inefficient operation

hich increases user costs. The author states that, he needs of the customer are paramount and eserve first consideration,' and therefore locks nd navigation facilities should be designed to max-nize user benefits. Trends in barge size are iscussed with respect to their effect on the effi-ency of existing waterways and locks, which is in rn related to the serviceability of the facilities to e customer. The importance of proper design of atures such as filling systems and guard walls in educing the lockage interval is elucidated. The lo-tion of locks with respect to river bends and cur-nts is discussed. Several examples of poorly cated facilities are presented and the adverse ef-ct of their location is demonstrated. The use of odel studies and consultation of the towing indus-y is advocated in determining optimum lock loca-on. (Hewett-Rutgers)
70-10349

ILLER V UNITED STATES (EVALUATION F LAND CONDEMNED BY UNITED STATES).
or primary bibliographic entry see Field 04A.
70-10428

B. Hydraulics

VOLUTION OF TIDEWATER PORT,
ulane Univ., New Orleans, La. School of En-neering.
hester A. Peyronnin, Jr.
SCE Proceedings, Journal of the Waterways and arbors Division, Vol 96, No WW2, Paper 7287, p 87-394, May 1970. 8 p, 6 fig.

escriptors: *Mississippi River, *Tides, *Sedimen-tion, *Harbors, *Louisiana, Inland waterways, orms, Water level fluctuations, Saline water in-usion.
entifiers: Port of New Orleans (La).

portion of the Port of New Orleans consists of an ner harbor connected to the Gulf of Mexico and ake Pontchartrain. The growth of this inner har-or is discussed with major emphasis on the ydraulic aspects. Such problems as current flow in e waterway complex, tidal flows and storm rges, salinity regime changes, and sedimentation the waterway are discussed. (Knapp-USGS)
70-10088

NTERNAL CURRENTS RESULTING FROM IN-ERMEDIATE DENSITY INFLOWS INTO TRATIFIED RESERVOIRS,
/ashington Univ., Seattle. Charles W. Harris ydraulics Lab.
or primary bibliographic entry see Field 02E.
70-10121

HE FLOW OF ROUND BUOYANT JETS ISSU-NG VERTICALLY INTO AMBIENT FLUID LOWING IN A HORIZONTAL DIRECTION,
/aterloopkundig Laboratorium, Delft (Nether-nds).
or primary bibliographic entry see Field 05G.
70-10209

OUNDARY SHEAR STRESS IN RIVERS AND STUARIES,
/ashington Univ., Seattle. Dept. of Civil Engineer-g.
or primary bibliographic entry see Field 02E.
70-10257

UASILINEARIZATION AND NONLINEAR ROBLEMS IN FLUID AND ORBITAL ECHANICS,
orth American Rockwell Corp., Downey, Calif.
ohn R. Radbill, and Gary A. McCue.
ew York, American Elservier Publishing Com-any, Inc, 1970. 228 p, 97 fig, 65 ref, 1 append.

Descriptors: *Flow, *Porous media, *Fluid mechanics, *Mathematical studies, Dynamic programming, Linear programming, Open channel flow, Hydrodynamics, Laminar flow, Turbulent flow, Boundary processes, Shear drag, Boundary layers, Reynolds number.
Identifiers: Quasilinearization.

This book is concerned with the analysis, formulations, and computational sophistication involved in the use of quasilinearization, a modern mathematical technique particularly suited to digital computer applications. It is a straightforward computational technique for solving systems of nonlinear differential equations, subject to two-point or multiple-point boundary conditions, in reasonable computing times. The method of quasilinearization leads to a scheme of successive approximations that converges rapidly (quadratically) and that requires moderate amounts of computation at each stage. Methods are given for solving fluid mechanics problems involving laminar boundary layers on walls bordering flowing fluids. The Falkner-Skan extension of the Blasius equation is examined because it displays, in a simple equation, the nonlinear (bilinear) behavior typical of boundary-layer problems and two point boundary conditions. A description and listing are presented for a general quasilinearization program. Most of these techniques are designed for use in solving problems in high-velocity fluid dynamics, plasma flow, and spacecraft orbital computation, but they are also useful for solving problems of laminar and turbulent pipe flow, open channel flow, and groundwater movement. (Knapp-USGS)
W70-10272

HYDRAULIC FIELD TESTS ON A SETTLING BASIN,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 05D.
W70-10379

8C. Hydraulic Machinery

MULTIPLE PURPOSE DEVELOPMENT OF THE ARKANSAS RIVER PROJECT INCLUDES HYDROELECTRIC POWER STATIONS OF UNUSUAL DESIGN,
Allis-Chalmers Mfg. Co., York, Pa.
W. L. Thomasson, and H. L. Reynolds.
Allis-Chalmers Report 54P4213, 1970. 8 p, 11 fig, 2 tab, 2 ref.

Descriptors: *Tube turbines, Hydraulic turbines, Kaplan turbines, Peak loads, Hydroelectric power, *Hydroelectric plants, Axial flow turbines, Multiple-purpose projects, Francis turbines, Locks, Electric generators, *Economic justification, Navigation, Electric power production, Costs.
Identifiers: Arkansas River, *Low-head hydro plants, Ozark Powerplant (Ark), Webbers Falls Powerplant (Okla), R S Kerr Powerplant (Okla).

Innovations in tube turbine development resulted in its use in the Ozark and Webbers Falls Powerplants on the Arkansas River, and may reopen many of the nation's low-head undeveloped hydroelectric sites. Prior to the tube turbine, the Francis, Kaplan, and fixed-blade propeller designs, all with vertical settings, have been used for low-head sites. In most cases, very low-head sites could not be justified economically with conventional units, but development of the tube turbine makes many of the uneconomical sites attractive. Installations at the Ozark and Webbers Falls plants are compared with the nearby R S Kerr plant which has a conventional Kaplan turbine in a vertical setting. (USBR)
W70-10129

ELECTROMAGNETIC CHARACTERISTICS OF ISOLATED BUNDLE CONDUCTORS,
Hong Kong Univ.
S. Y. King, and J. J. Raftery.
Proc Inst Elec Eng (Engl), Vol 117, No 4, p 753-760, Apr 1970. 8 p, 11 fig, 3 tab, 10 ref, append.

Descriptors: *Transmission (Electrical), *Bundled conductors, Digital computers, Transmission lines, *Electromagnetic properties, Electric currents, Alternating current, *Mathematical analysis, Resistance, Inductance, Magnetic fields, Foreign research, Errors, Conductors, Analytical techniques.
Identifiers: China, Test results, *Accuracy, *Current density, Skin effect (Electrical), Electric conductors.

With increased voltage for power transmission, bundled conductors have become more widely used. A numerical method of obtaining the electromagnetic characteristics of bundled conductors by a digital computer is given. Accuracy of the method is assessed by applying it to isolated conductors that involve analytic solutions. The method of solution uses successive approximations to the integral equations, and a highly convergent in all practical cases. Results confirming the technique are tabulated, the maximum error being 0.05%. (USBR)
W70-10133

GOBERNING CHARACTERISTICS FOR 820,000 HORSEPOWER UNITS FOR GRAND COULEE THIRD POWERPLANT,
Bureau of Reclamation, Denver, Colo.
F. R. Schleif, and C. G. Bates.
Translation, Paper 70 TP 527-PWR, Inst Elec Electron Eng Summer Power Meet EHV Conf, Los Angeles, Calif, July 1970. 7 p, 10 fig, 10 ref.

Descriptors: *Hydraulic turbines, *Speed regulators, Field tests, *Characteristics, Control, Mechanical properties, Performance, Thermal power, Hydroelectric power, Servomechanisms, Hydroelectric plants, Peaking capacities, Sensitivity, Stability, *Governors.
Identifiers: *Response time, Grand Coulee Powerplant, Wash, Base loads, Dashpots, Interconnected systems, *Governors (Hydraulic).

In selecting parameters for large hydropower generating units such as those selected for the Grand Coulee Third Powerplant, control characteristics to satisfy power system needs can strongly influence economics of the design. Need for abnormal mechanical inertia and expensive reduction of the penstock water starting time are mitigated by refinement of governor characteristics. Methods are described for selecting controllability to mechanical inertia and the penstock time constant to facilitate economic proportioning. The influence of a governing system and its refinement with several new features for improved performance are discussed. (USBR)
W70-10135

AUTOMATIC MECHANICAL IRRIGATION GATES,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
Allan S. Humpherys.
Seventh Congress on Irrigation Drainage, Quest 24, Rep Disc, R1-R24, Mexico City, p 24.251-24.261, 1969. 21 p, 12 fig, 1 ref.

Descriptors: *Irrigation systems, *Turnout gates, Irrigation, Gates, Automatic control, Water distribution (Applied), *Automation, *Surface irrigation, Design.
Identifiers: Labor savings, Floating weeds.

Small automatic irrigation gates for farm distribution systems are being developed to improve the efficiency of water use and to save labor. Two general classes of gates are described: (1) fully automatic gates that operate from energy of the water flowing in the ditch and require a minimum of attention from the operator; and (2) semiautomatic gates that require resetting or moving at each irrigation. Gate design and operating mechanisms for automatic and semiautomatic irrigation systems are

reviewed. An important requirement for all automatic irrigation systems is that the water and ditches be kept weed-free. Design of any automatic irrigation system should include a weed-screening device. (USBR)
W70-10145

TASK II REPORT: SURVEY OF POWER PLANT OPERATING CHARACTERISTICS AND DESIGN CRITERIA,
Dynatech R/D Co., Cambridge, Mass. Thermal Engineering Group.
For primary bibliographic entry see Field 05G.
W70-10316

GEORGIA POWER CO V FEDERAL POWER COMM'N (LICENSING OF HYDROELECTRIC POWER PLANT).
For primary bibliographic entry see Field 06E.
W70-10457

ALABAMA POWER CO V FEDERAL POWER COMM'N (FEDERAL POWER COMMISSION'S DETERMINATION OF HYDROELECTRIC PROJECT COSTS).
For primary bibliographic entry see Field 06E.
W70-10459

8D. Soil Mechanics

RADIOMETRIC METHOD OF SEEPAGE CONTROL IN DAMS AND THEIR ENVIRONS (RUSSIAN),
Polish Academy of Science, Gdansk. Inst. of Hydraulic Research.
For primary bibliographic entry see Field 07B.
W70-10105

AUSTRALIAN TRENDS IN TUNNEL FORMWORK,
A. N. Sharley.
Tunnels and Tunnelling, Vol 2, No 2, p 93-97, Mar-Apr 1970. 3 p, 5 fig.

Descriptors: *Tunnel construction, Tunneling, Tunnel linings, Tunnels, *Formwork (Construction), Foreign construction, Construction materials, Handling equipment, Foreign design practices, Arch.
Identifiers: Australia, Construction methods, Curbs, Tunnel supports, Construction practices.

Primary tunneling methods and design, construction, and handling of tunnel formwork in Australia are described. Most large tunnels driven in Australia have been constructed by using curb pours, followed by arch pours, and finished by invert pours. This has been a convenient method of construction, particularly for horseshoe-shaped tunnels. The method allows use of light, relatively portable forms to establish the curb to line and level and permits part of the tunnel lining to be placed, forming the basis of rapid location for heavy arch forms and invert forms or for traveling screeds for the invert. Curb forms have generally been of light construction, supported on stakes in the floor of the tunnel and spaced from the excavation at the upper edge of the forms by rock ties. Panel construction has been of suitably ribbed, light gage steel. Arch forms have been designed to be self-supporting between the curbs or the sides of the invert, with hinge locks incorporated to ensure that the form assembly acts as a 2- or 3-pin arch. Current practice in Australia is to fabricate forms so that the skin sheet and all supporting members are of integral construction. Transport of forms in tunnels is by a special-purpose, rail-mounted form-traveler or jumbo. (USBR)
W70-10127

LLYN BRIANNE DAM, SOUTH WALES,
W. J. Carlyle.
Civ Eng Pubic Works Rev, Vol 64, No 761, p 1195-1200, Dec 1969. 5 p, 9 fig, append.

Descriptors: *Earth dams, *Rockfill dams, Dam foundations, Dams, *Dam design, *Dam construction, Instrumentation, Geology, Grout curtains, Soil compaction, Earth materials, Foreign construction, Outlet works, Zoned embankments, Transition zones, Rock foundations, Rock properties, Soil properties, Grouting, Spillways, Drains, Diversion tunnels.
Identifiers: Blanket grouting, Dam stability, Chute spillways, Outlet tunnels, Great Britain, Sprayed concrete.

Llyn Brianne Dam, now being constructed on the River Towy, consists of an earth and rockfill embankment, an open chute spillway, tunnel diversion and outlet works, and fish handling facilities. Site geology, embankment design, materials selection, instrumentation, foundation treatment, features of the appurtenant structures, and construction are discussed. The dam embankment is 300 ft high and consists of a thin earthfill core protected by filter and transition zones and outer shells of rockfill. Rockfill is compacted in 3-ft layers by 4 passes of an 8.5-ton vibrating roller. Earthfill is compacted slightly wet of optimum water content in 12-in. layers by the 8.5-ton vibrating roller or by a 50-ton rubber-tired roller. The dam foundation is indurated slaty mudstone with minor graywacke beds covered by light overburden. Other than stripping overburden, foundation treatment is confined to the core contact area and includes excavation of open-jointed rock, removal of cliffs and crags, filling of local irregularities with dental concrete, coating the area with pneumatically applied cement mortar, blanket grouting the area, with curtain grouting up to 200 ft deep for the length of the dam. (USBR)
W70-10131

8E. Rock Mechanics and Geology

THE INFLUENCE OF ROCK CHARACTERISTICS ON THE STABILITY OF ROCK CAVITIES,
G. Lombardi.
Tunnels and Tunnelling, Vol 2, No 1, No 2, p 19-22, 104-109, Jan-Feb, Mar-Apr, 1970. 10 p, 17 fig, 5 ref.

Descriptors: *Rock mechanics, Rock properties, *Cavities, Deformation, *Tunnels, Tunnel pressures, Tunnel design, Stress distribution, Fissures (Geology), *Stress analysis, Anisotropy, *Stability, Foreign research, Tunnel linings, Residual stress, Discontinuities, Lateral forces, Strain, Stress.
Identifiers: *Rock pressure, Stress ratio, Openings, Rock dilation, Switzerland, Underground openings.

Concepts concerning the forces about cavities in rock formations are discussed. Included are: (1) natural or preexisting state of stress in rock, (2) rock properties that determine the effects of manmade changes to the geologic structure, (3) continuous and discontinuous rock systems, and (4) mechanical reactions of rock around an excavation. Results of a few analyzed cases show the effects in a tunnel of anisotropy and variation of inside pressure, friction angle, and laterial pressure. To determine formation pressure exerted on a tunnel lining, knowledge of the following values is essential: (1) existing stress conditions in the formation before construction begins, especially the ratio of vertical to horizontal stress; (2) cohesion and friction angle along fissure systems; and (3) volume increase caused by failure in the formation. With these values and a mathematically usable formulation of the construction sequence, all practical cases of cavities in rock can be analyzed. (USBR)
W70-10128

THE STABILITY OF PARTLY IMMERGED FISSURED ROCK MASSES, AND THE VAIONT ROCK SLIDE,
C. Jaeger.
Civ Eng Public Works Rev, Vol 64, No 761, p 1204-1207, Dec 1969. 4 p, 13 fig, 1 tab, 10 ref.

Descriptors: Stability, Stability analysis, *Slope stability, Banks, Earth movements, Mass wasting, *Landslides, *Rockslides, Rock mechanics, Soil mechanics, *Reservoirs, *Bank stability, Failures, Uplift pressure, Pore pressure, Pore water pressures, Engineering geology, Theory, Creep, Brittle failures, Failure (Mechanics).
Identifiers: Rock slope stability, Failure surfaces, *Vaiont slide, Italy.

Examination of conditions at the Vaiont slide in Italy shows that the usually accepted approach to the stability of reservoir banks is inadequate for explaining rock movements preceding and on the day of the explosive slide. The usually accepted approach and some general probleming concerning rockslides are discussed. Several papers are cited concerning the Vaiont slide. The event is described as starting with a small partial slide of the continuous visco-plastic type during the first partial filling of the reservoir. Movement and stabilization of the rock masses corresponded to raising and lowering of the reservoir water level respectively until just prior to failure, when lowering of the water level did not stop movement. A hypothesis of discontinuous movement of the rock masses is the only possible assumption in this case becuase continuous creep occurring along a concave sliding surface cannot accelerate suddenly. Uplift forces caused progressive deterioration of rock strength on the lower section of the sliding surface until a fragile rupture occurred, permitting a sudden acceleration of the rock masses. (USBR)
W70-10130

DETERMINING IN-SITU ROCK STRENGTH,
Falconbridge Nickel Mines Ltd.
K. H. S. Deshwar.
Eng Mining J, Vol 171, No 5, p 84-85, May 1970. 2 p, 1 fig, 2 tab, 7 ref.

Descriptors: *Rock mechanics, *Rock properties, Displacements, Poisson ratio, Rocks, Strength, Elasticity modulus, Discontinuities, Compressive strength, Laboratory tests, Methodology, Mechanical properties, Tensile strength, Youngs modulus, Elastic deformation.
Identifiers: *In situ rock, Empirical equations, Comparative studies, *Empirical methods, Elastic coefficient, Underground openings.

A simple technique for determining the in situ strength and elastic constants of rock structures is presented. The method is more accurate than present laboratory tests and considerably less expensive than field tests. The method is based on an empirical relationship between massive and small-scale properties of various rocks developed by Protodyakonov after a comprehensive investigation into the effects of planes of weakness on rock masses. Using in situ rock properties determined by the method, displacements of an underground excavation were computed by the finite element method and compared to measured displacements. Results show that the method gives a good approximation of in situ rock properties. (USBR)
W70-10132

RIVER MOUNTAINS TUNNEL,
Fluor Utah Engineers and Constructors, Inc., Henderson, Nev.
P. E. Sperry.
Proceedings, II Symporium on Rapid Excavation, p 11-1-11-12, Sacramento State College, Calif, Oct 1969. 12 p, 5 fig.

Descriptors: *Tunnel construction, Tunneling, *Tunneling machines, *Tunnels, Construction equipment, Construction, Surveying, Costs, Dust control, Engineering geology, Ventilation, Rock excavation, Rock bolts, Production, Laser.

dentifiers: *Construction methods, Cost savings, Cutters, Rapid excavation, *River Mountains Tunel, Nev.

he 19,970-ft-long, 10-ft-dia River Mountains unnel, a key feature of the Southern Nevada Vater Project, was excavated by a mechanical borng machine through rock thought to be too hard to ole. The tunnel traverses extrusive volcanic rocks f complex and variable geology. Individual rock ypes had extreme variations in hardness and drillaility. Tunneling equipment, construction rocedures, dust control, rock support, and alineent control are described. The mole had an vailability of 80%. Most downtime was caused by ailure of the drive pinion resulting from unanicipated high torque loads in drilling soft tuffs; emaining downtime was caused by repairs to the ydraulic system. Cutter life was longer than exected, resulting in an average cutter cost of less han $15 per foot of tunnel. Production of the mole aried from 10 ft per day in moist tuffs to 23 ft per r in ideal moling rock. Careful construction lanning had allowed for most problems encounered during the excavation, and the tunnel was oled through on schedule at a cost of $90 per ft, n estimated savings of $50 per ft over usual tunnel xcavation methods. (USBR)
V70-10137

ROBING THE MEDITERRANEAN'S HIDDEN EOLOGICAL PAST.
or primary bibliographic entry see Field 02J.
V70-10184

EVIEW OF COLLAPSING SOILS,
alifornia State Coll., Long Beach. Dept. of Civil ngineering.
or primary bibliographic entry see Field 02G.
V70-10256

8F. Concrete

HIN UNDERWATER CONCRETE STRUCTURES,
Massachusetts Inst. of Tech., Cambridge.
Odd E. Gjorv.
Proceedings, American Society of Civil Engineers, ournal of the Construction Division, Vol 96, No CO1, p 9-17, June 1970. 9 p, 5 fig, 1 tab, 8 ref, apend.

Descriptors: *Underwater construction, Concrete onstruction, Tremie concrete, Portland cements, Concrete structures, Performance, Piers, Durability, Corrosion, Inspection, Reinforcement, Cast-n-place structures, Underwater, Sea water.
dentifiers: *Construction methods, Undersea queduct (Collective), Corrosion environments, ulfate-resisting cements.

During the past half century, more reinforced oncrete wharves and piers of the slender-pillar ype have been constructed in Norwegian harbors han all other types of wharves put together. The nethod of pouring the slender, reinforced concrete illars underwater has made this type of wharf construction economically favorable. A comprehensive field inspection of 219 older structures of this type was made. The overall good condition observed proves that concrete can be placed successfully underwater, even for reinforced concrete members having relatively narrow cross sections. The findings emphasize that a proper casting technique is essential, and that sulfate-resisting cements are generally preferable in this type of underwater construction, even in cold climates. (USBR)
W70-10150

8G. Materials

MINIMIZING ERRORS IN GAMMA-RAY SURFACE-TYPE DENSITY GAGES: EXISTING GAGES AND NEW DESIGN CONCEPTS,
North Carolina State Univ., Raleigh.
William L. Dunn, and Frank H. McDougall.
Highway Research Record, No 301, p 40-52, 1970. 13 p, 3 fig, 8 tab, 6 ref.

Descriptors: *Densimeters, *Gamma rays, Soil density, Reviews, Errors, Design, *Gages, Instrumentation, Nuclear energy, Measurement, Radiation, Radiation measurement, Calibrations, Standards, Electronic equipment, Soil mechanics.
Identifiers: *Nuclear density meters, Backscattering, Spectrometry, Accuracy, Air gaps.

Backscatter-type nuclear density gages have been in existence for many years, but have been slow in gaining widespread commercial acceptance because accuracy of the gages has not been satisfactory. Research on identifying, measuring, and minimizing gage errors is reviewed, and suggestions for improving gage accuracy on present-generation commercial gages are included. The dual-gage principle offers much promise for improving gage performance. Optimum dual-gage systems are being designed on the basis of maximizing a quality factor that is a function of all gage errors and the measurement volume. Two prototype gages were constructed to aid in the evaluation. Results from initial testing of both systems are presented, indicating that a significant improvement in accuracy is possible. Present capabilities of gamma-ray surface-type density gages are summarized, techniques that may be applied to existing gages for obtaining the best possible performance are discussed, and new design concepts for developing more accurate and efficient gages are proposed. (USBR)
W70-10143

10. SCIENTIFIC AND TECHNICAL INFORMATION

BOREHOLE DILUTION TECHNIQUES: A CRITICAL REVIEW,
International Atomic Energy Agency, Vienna (Austria); Federal Experimental and Research Inst., Vienna (Austria); and Institute of Nuclear Research, Kracow (Poland).
For primary bibliographic entry see Field 07B.
W70-10103

REMOTE SENSING OF EARTH RESOURCES, A LITERATURE SURVEY WITH INDEXES.
National Aeronautics and Space Administration, Washington, D.C.
For primary bibliographic entry see Field 07B.
W70-10126

ANNUAL CYCLE OF PHYTOPLANKTON AND OF PRIMARY PRODUCTION IN TROPICAL SEAS (IN FRENCH),
Museum National d'Histoire Naturelle, Paris (France). Laboratoire des Peches Outre-Mer.
For primary bibliographic entry see Field 02K.
W70-10172

ENVIRONMENTAL POLLUTION-A SELECTIVE BIBLIOGRAPHY.
Clearinghouse for Federal Scientific and Technical Information, Springfield, Va. Information Services Section.

May 1970. 32 p.

Descriptors: *Bibliographies, *Water pollution, *Air pollution, Pesticides, Population, Radioactive wastes, Waste disposal, Waste treatment, Oily water, Thermal pollution, Pollution abatement.
Identifiers: Pollution bibliography, Environment pollution.

This bibliography of approximately 300 items, lists federally sponsored research in air and water pollution by such departments and agencies as HEW, Interior, AEC, NASA, Defense, Transportation and others. These reports do not represent all that are available from the Clearinghouse, but were selected from those appearing in our announcement journals during the period 1968 through April 1970. Unless otherwise specified, reports are available from the Clearinghouse. Ordering instructions are given. Specific pollution topics listed include engine exhausts, sulfur oxides, noise, pesticides, population, radioactive contamination, wastes (general), wastes (treatment), water pollution (general), water pollution (oil), and water pollution (thermal). (Knapp-USGS)
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A REVIEW OF CHLORINATED BIPHENYL CONTAMINATION IN NATURAL WATERS,
Wisconsin Univ., Madison, Water Chemistry Lab.
For primary bibliographic entry see Field 05B.
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ANNOTATED BIBLIOGRAPHY ON HYDROLOGY AND SEDIMENTATION 1966-1968, UNITED STATES AND CANADA.
Water Resources Council, Washington, D.C.
For primary bibliographic entry see Field 02E.
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A REVIEW OF THE LITERATURE OF 1966 ON WASTE WATER AND WATER POLLUTION CONTROL,
For primary bibliographic entry see Field 05D.
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